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TRANSACTIONS

OF THE

# AMERICAN ORTHOPEDIC ASSOCIATION.

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*FIFTEENTH SESSION,*

HELD AT NIAGARA FALLS,

JUNE 11, 12, AND 13, 1901.

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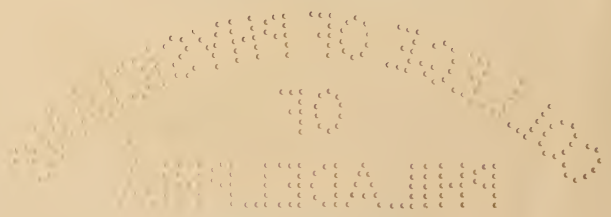

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# LIST OF OFFICERS.

[Elected June 13, 1901.]

---

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W. R. TOWNSEND, M.D.
*Alternate:* R. W. LOVETT, M.D.

## LIST OF PRESIDENTS.

1887. V. P. GIBNEY, M.D.
1888. NEWTON M. SHAFFER, M.D.
1889. E. H. BRADFORD, M.D.
1890. DE FOREST WILLARD, M.D.
1891. A. B. JUDSON, M.D.
1892. BENJAMIN LEE, M.D.
1893. A. J. STEELE, M.D.
1894. A. M. PHELPS, M.D.
1895. JOHN RIDLON, M.D.
1896. ROYAL WHITMAN, M.D.
1897. SAMUEL KETCH, M.D.
1898. R. W. LOVETT, M.D.
1899. W. R. TOWNSEND, M.D.
1900. H. M. SHERMAN, M.D.
1901. A. J. GILLETTE, M.D.
1902. H. AUGUSTUS WILSON, M.D.

# MEMBERS.

* Original Members.

1901. Bartow, Bernard, M.D. Clinical Professor Orthopedic Surgery, Medical Department University of Buffalo; Orthopedic Surgeon, Children's Hospital; Orthopedic Surgeon, Erie County Hospital; Consulting Orthopedic Surgeon, Buffalo General Hospital. 481 Delaware Avenue, Buffalo, N. Y.

1892. Blanchard, Wallace, M.D. Attending Orthopedic Surgeon to the Home for Destitute Crippled Children. 34 E. Monroe Street, Chicago.

1889. Brackett, E. G., M.D. Assistant Surgeon to the Children's Hospital. 133 Newbury Street, Boston.

*1887. Bradford, E. H., M.D. Visiting Surgeon to the Children's and the Good Samaritan Hospitals; Assistant Professor of Orthopedic Surgery in Harvard Medical School. 133 Newbury Street, Boston.

1889. Burrell, Herbert L., M.D. Visiting Surgeon to the Boston City Hospital; Visiting Surgeon to the Children's Hospital; Assistant Professor of Clinical Surgery, Harvard University. 22 Newbury Street, Boston.

1891. Cook, Ansel G., M.D. Orthopedic Surgeon to the Hartford Hospital. 164 High Street, Hartford, Conn.

1893. Coolidge, Frederic S., M.D. Demonstrator of Surgical Appliances in Rush Medical College; Professor of Orthopedic Surgery, Chicago Post Graduate Medical College; Attending Orthopedic Surgeon to the St. Luke's and St. Elizabeth's Hospitals; Attending Physician to Children, Presbyterian Hospital. 103 State Street, Chicago.

1895. Dane, John, M.D. Junior Assistant Surgeon to the Children's Hospital; Assistant Surgeon to the West End Infant Hospital. 29 Marlborough Street, Boston.

1897. Davis, Gwilym G., M.D. Univ. of Penna. and Goettingen, M.R.C.S. Eng. Surgeon to the Philadelphia Orthopedic, Episcopal, and St. Joseph's Hospitals; Assistant Professor of Applied Anatomy, University of Pennsylvania. 255 South Sixteenth Street, Philadelphia.

1900. Elliott, George R., M.D. Orthopedic Surgeon to Montefiore Home for Chronic Invalids. 48 East 26th Street, New York.

1901. Freiberg, Albert H., M.D. Professor of Orthopedic Surgery in the Laura Memorial Women's Medical College; Orthopedic Surgeon to the Cincinnati, Presbyterian and Jewish Hospitals. 706 Walnut Street, Cincinnati, Ohio.

*1887. Foster, Charles C., M.D. Orthopedic Surgeon to the Cambridge Hospital; Visiting Physician to the Avon Home for Children; Visiting Physician to St. Luke's Home for Children. 8 Elwood Avenue, Cambridge, Mass.

1899. Galloway, H. P. H., M.D. Surgeon to the Toronto Orthopedic Hospital; Orthopedic Surgeon to the Toronto Western Hospital; Orthopedic Surgeon to Grace General Hospital, Toronto. 12 East Bloor Street, Toronto, Canada.

*1887. Gibney, V. P., M.D. Clinical Professor of Orthopedic Surgery in the College of Physicians and Surgeons, Medical Department of Columbia University; Surgeon-in-Chief to the New York Hospital for Ruptured and Crippled; Orthopedic Surgeon to the Nursery and Children's Hospital and to the Montefiore Home and Hospital, New York. 16 Park Avenue, New York.

*1889. Gillette, Arthur J., M.D. Professor of Orthopedic Surgery in the Minnesota State University; Orthopedic Surgeon to St. Luke's, St. Joseph's, Bethesda, City and County Hospitals, and the St. Paul Free Dispensary, and Consulting Orthopedic Surgeon to Asbury Hospital; Surgeon-in-Charge of Minnesota State Hospital for Crippled and Deformed Children. 301 Pleasant Avenue, St. Paul, Minn.

1892. Goldthwait, Joel E., M.D. Orthopedic Surgeon to Carney Hospital; Consulting Orthopedic Surgeon to the Massachusetts General and the New England Hospitals; Assistant Surgeon to the Children's Hospital. 372 Marlborough Street, Boston.

1892. Griffiths, J. D., M.D. Lieutenant-Colonel and Medical Director First Brigade, National Guard of Missouri; President of the Association of Military Surgeons of the U. S.; Surgeon to St. Joseph's

Hospital, Kansas City; Consulting Surgeon to the German Hospital, Kansas City; Consulting Surgeon to the Kansas City, Fort Scott, and Memphis R. R. Southwest corner Ninth and Grand Avenue, Kansas City, Mo.

1898. Hoffmann, Phil., M.D. Clinical Lecturer on Orthopedic Surgery in the Medical Department, Washington University; Chief of the Orthopedic Clinic at St. John's Hospital. 705 North Channing Avenue, St. Louis, Mo.

1899. Hopkins, W. Barton, M.D. Visiting Surgeon to the Pennsylvania Hospital. 1904 South Rittenhouse Square, Philadelphia.

1893. Hosmer, A. B., M.D. Orthopedic Surgeon to St. Luke's Hospital. 103 State Street, Chicago.

1893. Hubbard, Le Roy W., M.D. Attending Surgeon for Orthopedic Cases at the Randall's Island Hospitals. 70 West Thirty-fifth Street, New York.

*1887. Judson, A. B., M.D. Orthopedic Surgeon to the Out-patient Department of the New York Hospital. 1 Madison Avenue, New York.

1894. Kerr, James, M.D., M.Ch. 1711 H Street, N. W., Washington, D. C.

*1887. Lovett, Robert W., M.D. Surgeon to the Infants' Hospital; Assistant Surgeon to the Children's Hospital; Assistant Surgeon to the Boston City Hospital. 234 Marlborough Street, Boston.

1893. McCurdy, Stewart Le Roy, A.M., M.D. Orthopedic Surgeon to the Presbyterian Hospital and East End Dispensary; Professor of Anatomy and Oral Surgery, Pittsburg Dental College; Dean of Pittsburg School of Anatomy. 515 Pennsylvania Avenue, Pittsburg, Pa.

1889. McKenzie, B. E., B.A., M.D Surgeon to the Toronto Orthopedic Hospital; Orthopedic Surgeon to the Grace General Hospital; Associate Professor of Clinical Surgery, Ontario Medical College for Women. 12 East Bloor Street, Toronto, Canada.

1901. McKim, Smith Hollins, M.D. House Surgeon to the Hospital for the Relief of Crippled and Deformed Children; Chief of

Clinic to the Professor of Orthopedic Surgery, University of Maryland. 2000 N. Charles Street, Baltimore, Md.

1889. Myers, T. Halsted, M.D. Attending Orthopedic Surgeon to St. Luke's and New York Foundling Hospitals; Attending Surgeon to the New York Orthopedic Dispensary; Consulting Surgeon to St. John's Riverside Hospital, Home of the Annunciation, and New York Lying-in Hospital. 24 West Fiftieth Street, New York.

*1887. Packard, George B., M.D. Professor of Orthopedic Surgery in the Denver College of Medicine; Orthopedic Surgeon to the Arapahoe County Hospital. 732 Fourteenth Street, Denver.

1899. Painter, Charles F., M.D. Instructor in Orthopedic Surgery at Tufts Medical School; Visiting Surgeon to the House of the Good Samaritan; Assistant Orthopedic Surgeon to the Carney Hospital. 372 Marlborough Street, Boston.

*1887. Park, Roswell, M.D. Professor of Surgery in the Medical Department of the University of Buffalo; Surgeon to the Buffalo General Hospital; Consulting Surgeon to the Fitch Accident Hospital and the Buffalo Eye and Ear Infirmary. 510 Delaware Avenue, Buffalo, N. Y.

1900. Peckham, Frank E., M.D. Orthopedic Surgeon to the Rhode Island Hospital. 266 Benefit Street, Providence, R. I.

1901. Pegram, John C., Jr., M.D. Orthopedic Surgeon to St. Joseph's Hospital and to the Rhode Island Catholic Orphan Asylum; Orthopedic Surgeon to the Rhode Island Hospital; Consulting Surgeon to the Butler Hospital for the Insane; Demonstrator of Anatomy, Brown University. 277 Benefit Street, Providence, R. I.

1890. Phelps, A. M., M.D. Professor of Surgery in the University of Vermont; Professor of Orthopedic Surgery in the University of the City of New York, Medical Department; Professor of Orthopedic Surgery in the Post-Graduate Medical School and Hospital; Visiting Surgeon to the City Hospital, New York; Consulting Surgeon to the Mary Fletcher Hospital, Burlington, Vt.; Surgeon-in-Chief to the Orthopedic Department of the Post-Graduate Hospital, New York. 62 East Thirty-fourth Street, New York.

1893. Plimpton, W. O., M.D. Instructor in Orthopedic Surgery, Post-Graduate Medical School and Hospital; Assistant to the Chair of Orthopedic Surgery, University Medical School; Visiting Surgeon to the Post-Graduate Hospital, New York. 40 West Thirty-fourth Street, New York.

1901. Porter, John L., M.D. Professor of Orthopedic Surgery, College of Physicians and Surgeons (Medical School of University of Illinois); Assistant Attending Orthopedic Surgeon, Home for Destitute Crippled Children; Attending Orthopedic Surgeon, St. Luke's Dispensary. 103 State Street, Chicago.

*1887. Ridlon, John, M.D. Professor of Orthopedic Surgery in the Northwestern University Medical School and Northwestern University Women's Medical School; Senior Attending Orthopedic Surgeon to St. Luke's Hospital and Michael Reese Hospital; Orthopedic Surgeon to the Wesley Hospital and the Evanston Hospital; Surgeon-in-Charge of the Home for Destitute Crippled Children; Orthopedic Surgeon to the Chicago Hospital School; Consulting Orthopedic Surgeon to the Mary Thompson Hospital for Women and Children. 103 State Street, Chicago.

*1887. Sayre, Reginald H., M.D. Clinical Professor of Orthopedic Surgery in the University and Bellevue Hospital Medical College; Orthopedic Surgeon to the Out-door Department of the Bellevue Hospital; Consulting Surgeon to the Hackensack (N. J.) Hospital; Consulting Surgeon to the Hospital for Sick Children, Newark, N. J. 285 Fifth Avenue, New York.

*1887. Schapps, John C., M.D. Pony, Mont.

*1887. Shaffer, Newton M., M.D. Surgeon-in-Chief to the New York State Hospital for the Care of Crippled and Deformed Children; Professor of Orthopedic Surgery, Cornell University Medical College; Consulting Orthopedic Surgeon to St. Luke's and Presbyterian Hospitals; Consulting Surgeon to the New York Infirmary for Women and Children. 28 East Thirty-eighth Street, New York.

1896. Shands, A. R., M.D. Professor of Orthopedic Surgery in the Medical Department of Columbian University; Assistant Physician-in-Charge of General Diseases at Emergency Hospital and Central Dispensary; Surgeon-in-Charge of Orthopedic Department Emergency Hospital and Central Dispensary; Attending Physician to Newsboys' Home and Children's Aid Society. 1319 New York Avenue, Washington, D. C.

1889. Sherman, Harry M., A.M., M.D. Orthopedic Surgeon to the Children's Hospital, San Francisco; Clinical Professor of Orthopedic Surgery in the Medical Department of the University of California. 1303 Van Ness Avenue, San Francisco.

1900. Starr, Clarence L., M.D. Orthopedic Surgeon to Hospital for Sick Children; Registrar to Toronto General Hospital; Demonstrator of Clinical Surgery in Medical Faculty, University of Toronto. 95 Bloor Street West, Toronto, Canada.

*1887. Steele, A. J., M.D. Professor of Orthopedic Surgery in the Medical Department of Washington University; Orthopedic Surgeon to the Martha Parsons Children's Hospital, and to the Missouri Baptist Sanitarium. 2825 Washington Avenue, St. Louis.

*1887. Taylor, Henry Ling, M.D. Clinical Assistant at the Hospital for the Ruptured and Crippled. 60 West Fifty-fifth Street, New York.

1897. Taylor, Robert Tunstall, B.A., M.D. Surgeon-in-Charge of the Hospital for the Relief of Crippled and Deformed Children of Baltimore City; Clinical Professor of Orthopedic Surgery of Woman's Medical College; Demonstrator of Orthopedic Surgery in Baltimore Medical College. 2000 Maryland Avenue, Baltimore, Md.

1892. Taylor, William J., M.D. Attending Surgeon to the Orthopedic Hospital and Infirmary for Nervous Diseases and to St. Agnes' Hospital; Consulting Surgeon to the West Philadelphia Hospital for Women. 1825 Pine Street, Philadelphia.

1892. Thorndike, Augustus, M.D. Surgeon to Good Samaritan Hospital; Assistant Surgeon to West End Infant Hospital and Junior Assistant Surgeon to Children's Hospital. 601 Beacon Street, Boston.

1889. Townsend, W. R., M.D. Professor of Orthopedic Surgery in the New York Polyclinic; Assistant Surgeon to the Hospital for Ruptured and Crippled, New York; Visiting Surgeon to Randall's Island and Bayonne Hospitals; Consulting Orthopedic Surgeon to the French Hospital. 23 West Fifty-third Street, New York.

1901. Waterman, J. Hilton, M.D. Instructor in Orthopedic Surgery in the New York Polyclinic Medical School and Hospital; Clinical Assistant in the Hospital for the Relief of the Ruptured and Crippled. 24 West Fifty-third Street, New York.

1889. Weigel, Louis A., M.D. Professor of Orthopedic Surgery in the Medical Department of Niagara University, Buffalo; Orthopedic Surgeon to Rochester City Hospital and Out-patient Department; Consulting Orthopedic Surgeon to Provident Dispensary. 209 East Avenue, Rochester, N. Y.

1890. Whitman, Royal, M.D. Instructor in Orthopedic Surgery and Chief of the Orthopedic Division of the Vanderbilt Clinic in the

College of Physicians and Surgeons; Adjunct Professor of Orthopedic Surgery in the New York Polyclinic; Assistant Surgeon to the Hospital for Ruptured and Crippled, New York. 126 West Fifty-ninth Street, New York.

*1887. Willard, De Forest, M.D. Clinical Professor of Orthopedic Surgery in the University of Pennsylvania; Surgeon to the Presbyterian Hospital; Consulting Surgeon to the White Cripples' Home, the Colored Cripples' Home, and the Home for Incurables, Philadelphia; Consulting Surgeon to the New Jersey State School for Feeble-minded Children. 1818 Chestnut Street, Philadelphia.

1891. Wilson, H. Augustus, M.D. Clinical Professor of Orthopedic Surgery in the Jefferson Medical College; Professor of General and Orthopedic Surgery in the Philadelphia Polyclinic and College for Graduates in Medicine; Consulting Orthopedic Surgeon to the Kensington Hospital for Women and to the Philadelphia Lying-in Charity. 1611 Spruce Street, Philadelphia.

1893. Wirt, William E., M.D. Professor of Orthopedic Surgery in the Medical Department, University of Wooster; Visiting Surgeon to University Hospital; Orthopedic Surgeon to Cleveland Hospital for Women and Children, Cleveland, Ohio. 122 Euclid Avenue, Cleveland, Ohio.

1890. Young, James K., M.D. Professor of Orthopedic Surgery, Philadelphia Polyclinic; Clinical Professor of Orthopedic Surgery in the Woman's Medical College; Assistant Orthopedic Surgeon to the Hospital, University of Pennsylvania; Instructor in Orthopedics in University of Pennsylvania; Surgeon to the Home for Crippled Children; Orthopedic Surgeon, Hospital of the Good Shepherd, Radnor. 222 South Sixteenth Street, Philadelphia.

## DECEASED.

### HONORARY MEMBERS.

Elected

1889. Henry G. Davis, M.D.
1892. William Detmold, M.D.
1889. William J. Little, M.D., F.R.C.P. Lond., M.R.C.S. Eng.
1893. Leopold Ollier, M.D.
1889. David Prince, M.D.
1889. Lewis A. Sayre, M.D.
1891. C. Fayette Taylor, M.D.

### CORRESPONDING MEMBERS.

1894. Bernard E. Brodhurst, F.R.C.S. Eng.
1892. Nicholas Grattan, F.R.C.S. Edin.
1890. Hugh Owen Thomas, M.R.C.S. Eng.

### ACTIVE MEMBERS.

1887. Buckminster Brown, M.D.
1887. Edward Develin, M.D.
1892. A. E. Hoadley, M.D.
1887. Harry Hodgen, M.D.
1887. Samuel Ketch, M.D.
1887. George W. Ryan, M.D.
1887. Lewis Hall Sayre, M.D.

# HONORARY MEMBERS.

ELECTED

1895. WILLIAM ADAMS, F.R.C.S., Senior Surgeon to the Great Northern Central Hospital and to the National Hospital for the Paralytic and Epileptic; Consulting Surgeon to the National Orthopedic Hospital. 7 London Road, St. John's Wood (N. W.), London, England.

1891. EDMUND ANDREWS, M.D., 65 Randolph Street, Chicago, Illinois.

1893. O. LANNELONGUE, Professeur à la Faculté de Médecine de Paris (Chaire de Chirurgie); Membre de l'Académie de Médecine; Chirurgien de l'Hôpital Trousseau â Paris, et Député au Parlement Français, et Président de l'Association Générale de Médecine de France. 3 Rue François I., Paris.

1897. BENJAMIN LEE, M.D., Secretary of the State Board of Health of Pennsylvania. Crozer Building, 1420 Chestnut St., Philadelphia, Pa.

1890. WILLIAM MACEWEN, M.D., LL.D., Professor of Clinical Surgery and Surgeon to the Glasgow Royal Infirmary; Surgeon to the Royal Hospital for Sick Children. 3 Woodside Crescent, Glasgow, Scotland.

1900. JAMES E. MOORE, M.D., Professor of Clinical Surgery and Orthopedic Surgery in the University of Minnesota; Orthopedic Surgeon to St. Mary's Hospital; Consulting Surgeon to the Northwestern Hospital for Women and Children; 802 Dayton Building, Minneapolis, Minn.

ELECTED

1889. Dr. ADOLF LORENZ. IX. Garnisongasse 3 (Garellihoff), Vienna, Austria.

1889. HOWARD MARSH, F.R.C.S. Eng., Senior Assistant Surgeon and Lecturer on Surgery, St. Bartholomew's Hospital; Consulting Surgeon, Hospital for Sick Children, and Alexandra Hospital for Hip Disease. 30 Bruton Street, W., London, England.

1890. EDMUND OWEN, M.B., F.R.C.S., Surgeon to and Joint Lecturer on Surgery at St. Mary's Hospital; Senior Surgeon to the Hospital for Sick Children, Great Ormond Street. 64 Great Cumberland Place, W., London, England.

1892. PIETRO PANZERI, M.D., Direttore di Istitutio dei Rachitici, Milano. Via S. Calimero 31, Milano, Italy.

1892. ROBERT WILLIAM PARKER, M.R.C.S. Eng., Senior Surgeon, East London Hospital for Children; Surgeon, German Hospital, Dalston. 13 Welbeck Street, W., London, England.

1890. PAUL REDARD, M.D., Lauréat de l'Institut; Ancien Chef de Clinique Chirurgicale de la Faculté de Médecine de Paris; Chirurgien du Dispensaire Furtado-Heine. 3 Rue de Turin, Paris, France.

1888. BERNARD ROTH, F.R.C.S. Eng., Orthopedic Surgeon to the Royal Alexandra Children's Hospital, Brighton. 38 Harley Street, Cavendish Square, W., London, England.

1890. NOBLE SMITH, F.R.C.S. Edin., L.R.C.P. Lond., M.R.C.S. Eng., M.D., Surgeon to All Saints' Children's Hospital; Orthopedic Surgeon to British Home for Incurables. Senior Surgeon to the City Orthopedic Hospital. 24 Queen Anne Street, Cavendish Square, W., London, England.

1899. ALFRED H. TUBBY, M.S., M.B. Lond., F.R.C.S. Eng., Surgeon to the Westminster, National Orthopedic and Evelina Hospitals. 25 Weymouth St., Portland Place, W., London, England.

1899. OSCAR VULPIUS, Privatdozent der Chirurgie au der Universitat Heidelberg, Dozent für Orthopädische Chirurgie Dirigirender Arzt der Orthopädische Chirurgischen Heilaustalt in Heidelberg, Luisenstrasse No. 1.

ELECTED

1890. W. J. WALSHAM, F.R.C.S. Eng., M.B. and C.M. Aberdeen, Joint Surgeon and Lecturer on Surgery at St. Bartholomew's Hospital; Surgeon to Metropolitan Hospital; Consulting Surgeon to Hospital for Hip Diseases, Sevenoaks, and to the Bromley Cottage Hospital. 77 Harley Street, London, England.

1890. GEORGE ARTHUR WRIGHT, B.A., M.B. Oxon., F.R.C.S., Senior Assistant Surgeon, Royal Infirmary, Manchester; Surgeon to Children's Hospital, Pendlebury and Manchester. 8a St. John Street, Manchester, England.

# CONSTITUTION AND BY-LAWS.

## CONSTITUTION.

### ARTICLE I.—NAME.

This Society shall be called the "American Orthopedic Association."

### ARTICLE II.—OBJECT.

The purpose of this Association shall be the advancement of orthopedic science and art.

### ARTICLE III.—MEMBERSHIP.

Section 1. The members shall be graduates of regular medical schools, shall be in good professional standing, and shall be especially interested in Orthopedic Surgery.

Sec. 2. There shall be three classes of members, viz.: Acting, Corresponding, and Honorary.

Sec. 3. The number of Active Members shall be limited to sixty, and of Corresponding Members to thirty.

Sec. 4. Candidates for membership shall have been engaged in the practice of medicine for at least five years, and shall have given evidence of satisfactory scientific attainments.

### ARTICLE IV.—OFFICERS.

The officers shall consist of a President, a First Vice-President, a Second Vice-President, a Secretary, and a Treasurer, all to be elected annually at the last executive session of a regular meeting.

### ARTICLE V.—STANDING COMMITTEES.

There shall be a Committee on Membership, consisting of five members, a Committee on Publication, consisting of three members, and an Executive Committee, consisting of the President, the Secretary, and the Treasurer.

### ARTICLE VI.—ELECTIONS.

All elections shall be by ballot; for officers a majority shall elect, for members a four-fifths majority.

### ARTICLE VII.—MEETINGS.

The meetings of the Association shall be Regular and Special.

### ARTICLE VIII.—FEES.

Active members shall pay an initiation fee of twenty-five dollars, and annual dues of fifteen dollars.

### ARTICLE IX.—PUBLISHED PROCEEDINGS.

The business proceedings of the Association shall be published annually. The papers and discussions shall be published annually, unless the Association otherwise directs at the close of the regular meeting.

### ARTICLE X.—DISCIPLINE.

A three-fourths vote of all members present at a regular meeting shall be necessary for suspension or expulsion of a member.

### ARTICLE XI.—THE CONGRESS.

SECTION 1. This Association shall hold membership in and meet with the Congress of American Physicians and Surgeons.

SEC. 2. It shall, at the first annual meeting held after the adjournment of any Congress, elect a member to represent it on the Executive Committee of the Congress for the ensuing three years, and it shall also elect a second member as an alternate.

### ARTICLE XII.—QUORUM.

An actual presence of nine active members at any one meeting shall be necessary for the transaction of business.

### ARTICLE XIII.—AMENDMENTS.

Alterations to this Constitution may be made at any regular meeting by a four-fifths vote of all the members present; provided that notice

of the proposed changes, signed by two active members, shall have been given to all the active members at least one month previous to final action.

## BY-LAWS.

### ARTICLE I.—MEMBERSHIP.

SECTION 1. Nominations for membership shall be made in writing, signed by the proposer and seconder, accompanied by evidence as to the fitness of the candidate for fellowship, and shall be placed in the hands of the Secretary at the previous meeting to the time of the regular meeting. The names of the candidates for membership, together with a statement of their official positions, and the names of their proposers and seconders shall be sent by the Secretary to each Active Member of the Association at least one month before the time of the annual meeting.

SEC. 2. Candidates for active membership shall, through the Secretary, present a paper to the Association.

SEC. 3. Only those of acknowledged pre-eminence in orthopedic surgery shall be eligible to honorary membership.

SEC. 4. Foreign residents only shall be eligible to corresponding membership.

SEC. 5. All the scientific privileges of the Association shall be accorded to the honorary and corresponding members.

SEC. 6. Membership shall be forfeited when one ceases to take an active interest in the objects of the Association, or is guilty of an unprofessional act or a public misdemeanor. Action in such cases shall be taken according to Article X. of the Constitution.

SEC. 7. An active member absenting himself for three consecutive meetings, or two years in arrears in payment of dues, may be dropped from the rolls.

SEC. 8. All members in attendance at any meeting shall register in a book provided for the purpose.

### ARTICLE II.—OFFICERS AND STANDING COMMITTEES.

SECTION 1. The duties of officers and standing committees shall commence after the adjournment of the meeting at which they are elected or appointed, and shall continue until their successors are duly installed.

SEC. 2. The President shall preside at all meetings, shall deliver an annual address, shall appoint a Committee on Membership of five, two

of whom shall have served the preceding year, and a Committee on Publication, and shall fill any vacancies that may occur from resignation or otherwise. The names of the members of the committees thus appointed by the President shall be printed in the annual minutes.

Sec. 3. The Vice-President shall act in the absence of the President.

Sec. 4. The Secretary shall give due notice of and keep the minutes of all meetings, shall conduct all correspondence, shall notify candidates of their election to membership, shall send all papers pertaining to candidates for membership to the chairman of the Committee on Membership one month previous to the time of the annual meeting, including their theses, and inform members of their appointment on committees, and shall perform such other duties as are assigned to him by the Association.

Sec. 5. The Treasurer shall collect all moneys due the Association, be the custodian of the same, and pay it out only on warrant signed by the President and Secretary. At the annual meeting he shall make a report of his receipts and expenditures, which, after being duly audited, shall be filed.

Sec. 6. The Membership Committee shall consider the eligibility of all nominees for membership, and shall report its recommendations to the Association.

Sec. 7. The Executive Committee shall make all necessary arrangements for the meetings of the Association, assign the order for scientific work, and report the same to all members as early as practicable before the time of the annual meeting. It shall further manage such necessary affairs of the Association as are not already assigned to others.

Sec. 8. The Publication Committee, of which the retiring President shall be one, shall attend to the preparation, publication, and distribution of the annual proceedings of the Association; and shall have discretionary power as to the matter for publication in questionable cases.

## ARTICLE III.—ELECTIONS.

The election of officers and members shall be held at the last executive session of the regular meeting.

## ARTICLE IV.—MEETINGS.

Section 1. The regular meetings shall be held annually during the third week in May of each year, or at such other time and at such place as the Association may elect. If no action should be taken in the matter, the Executive Committee shall decide.

Sec. 2. Special meetings may be called by the Executive Committee or by the President at the written request of ten active members.

Sec. 3. Every third year the Association shall convene as a part of the Congress of American Physicians and Surgeons.

### ARTICLE V.—DUES.

The yearly dues shall be paid to the Treasurer at the time of registration.

### ARTICLE VI.—PUBLISHED PROCEEDINGS.

Section 1. The Transactions shall be printed as soon after the adjournment of the regular meeting as possible, and distributed to the members, one copy to each, except to those in arrears on Association dues.

Sec. 2. Additional copies of the Transactions shall be furnished to members at cost, and to the public at a price to be determined by the Publication Committee.

Sec. 3. Authors desiring reprints of their papers will notify the Publication Committee, who shall already have established rates for reprints with the publishers.

Sec. 4. Papers not in the hands of the Secretary within four weeks after adjournment of the meeting shall be omitted from the Transactions on the unanimous vote of the Publication Committee.

### ARTICLE VII.—PAPERS AND DISCUSSIONS.

Section 1. Papers read before the Association shall be limited to twenty minutes, unless the time be extended by vote. Discussions shall be limited to five-minute speeches. No member shall speak a second time on the same subject if others desire the floor. The author of the paper shall be privileged to close the debate.

Sec. 2. No papers shall be read that have been previously published. Members publishing their papers after they have been presented to the Association shall designate them, "Read before the American Orthopedic Association." Authors desiring their papers illustrated shall furnish the necessary wood-cuts.

Sec. 3. Proofs sent to authors should be returned within a fortnight, otherwise the matter will go to press without the author's corrections. Marked changes from copy, known as "time-work," shall be paid for by the author.

Sec. 4. Transcripts of the discussion shall be furnished the participants for correction, but not for rewriting.

### ARTICLE VIII.—EXECUTIVE.

SECTION 1. Two executive sessions shall be held during each regular annual meeting—to wit: at noon of the first day and at noon of the last day. The order of business shall be:

1. Reading of unapproved minutes and records.
2. Reports of officers and committees and action thereon.
3. Unfinished business.
4. Election.
5. New business.

The last act before the adjournment of the last session shall be the reading of unapproved minutes and action thereon. Urgent business may be transacted at any session by unanimous consent.

SEC. 2. The proceedings of the Association shall be in accordance with parliamentary usage.

### ARTICLE IX.—AMENDMENTS.

All proposed amendments to the By-laws shall be submitted in writing, signed by two active members, at a previous annual meeting. A three-fourths affirmative vote of all members present at a regular meeting shall be necessary to ratification.

## THE PRESIDENT'S ADDRESS.

# INJURIES TO THE SPINE FROM AN ORTHOPEDIC STAND-POINT.

By ARTHUR J. GILLETTE, M.D.,
ST. PAUL.

It is a fact that a certain percentage of cases of trauma to the spine may be the localizing cause of a tuberculosis of the vertebræ, but there are traditions and impressions in general not so well verified, to which special attention is called.

Because of so many trumped-up "medico-legal spinal troubles" it has become almost a disgrace for a physician to give as his opinion that a man has received an injury to the spine of any consequence unless evidence of a cord lesion exists or a deformity is manifest; yet we know that we may have a wrench of the spinal column, resulting in a sprain which may produce a serious condition, sometimes immediately following the injury and at times remote.

The term concussion, which is frequently used in these cases, is vague, and must give way to the divisions, organic lesions, and psychical conditions.

The reason for the so-called term "spinal concussions," of which we read so much in the older surgeries, and even in the more modern ones, too, is because of the prevailing opinion that a paralysis does not occur unless you have a fracture, or a dislocation, or a hemorrhage; and therefore in the paralysis and cord lesion following injuries where fracture, dislocation, or hemorrhage could not be demonstrated there was no way to explain the condition but by the term "concussion" until we brought the microscope to our aid in post-mortems.

It is strange, too, that we do not realize that we may have what we term a simple sprain of the back, that may take months for recovery and entail a great deal of suffering, just as everyone knows we may have in the knee or ankle, especially if it has been improperly treated, as we know sprains have been for years.

A sprain of the spine must be even more complicated—the spine consisting, as it does, of a number of separate joints of various sizes and shapes, each with its various joint structures, and, in addition, the spinal cord running in a canal nearly the whole of its length; and in very close proximity to the sprain or the injury are the various nerves which pass out on either side. The ligaments may be torn or stretched, twisted or wrenched, the nerves bruised or crushed, the muscles detached from their bed and torn across, and there may be a consequent greater or less local hemorrhage without any external evidence of the condition, not even of paralysis; and if paralysis under such circumstances should exist or ensue the condition has been called "concussion" instead of contusion, and hemorrhage of the spinal cord or extension of the inflammation to the membrane, or to the cord itself, or swelling and effusion at the seat of the injury—inflammatory exudate.

Fig. 1 is an illustration to support the statement that the ligaments may be ruptured without a fracture. Wishing to refer to the case later, I will simply state that the case was that of an injury to a man falling from his wagon, face downward, the wheels passing over his body. On post-mortem all of the vertebral tissues in front of the vertebræ, including the anterior common ligament, were found to be completely torn across.

We have another condition following spinal injuries which is quite remote—that is, "traumatic spondylitis;" and before the American Orthopedic Association alone at various times there have been reported by different authors twenty-five well-authenticated cases of this condition of inflammation of the spinal column following the injury. The symptoms in these cases resembled very closely Pott's disease. Some of these had paralysis, some of them were cured, and in others death occurred. The post-mortem findings demonstrated that in two cases there was suppurative osteitis, and there was no evidence of the bacilli of tuberculosis either macroscopically or microscopically.

FIG. 1.

Since we know that so many infections may occur in the joints from the various pyogenic germs entering and found in the body, it is not surprising that following an injury to the spine this infection should occur.

Uncomplicated dislocations of the spine are so rare and non-demonstrable that they should not receive the separate distinction which they do in the literature on spinal injuries.

A review of reported cases of dislocations, unverified by post-mortem, would lead us to believe that a simple dislocation without a fracture never occurred except in the cervical region, and in the cervical region a very extensive laceration and mangling of the soft parts must take place to a greater or less extent.

It is impossible, in a living subject, to differentiate between a dislocation and a fracture even where deformity exists, as crepitus is rare in a fracture of the vertebræ except in a fracture of the posterior segment.

Even incised wounds of the back might be considered from an orthopedic stand-point where the wound involves injury to the spinal cord and the tissues about it.

If we are influenced at all by writings and records, the most interesting part of spinal injuries to be considered is fracture of the vertebræ. It is especially remarkable to note the tenacity with which certain ideas have clung to the profession in general for many years. For instance, a few years ago a man was injured in a railroad accident near St. Paul. Following the accident the man walked a little way and then rode several miles to the railroad hospital. The local surgeon diagnosed a fracture of the vertebræ, and so telegraphed his chief. When the man arrived at the hospital there was no evidence of paralysis, and he complained of pain only in his back and sides. The staff was consulted. All were men of considerable experience, and without hesitation they stated that it was impossible for a man to have a fracture of the spine without a paralysis. Later, when the man was allowed up and about, the pain in his back and limbs returned, and there was a slight deformity in the lower dorsal spine. They still did not believe that it was due to the injury, although a Taylor brace greatly relieved the pain, which was significant, as the relief was admitted before the trial. They refused this man any indemnity,

and the defence attempted to prove that this condition of deformity and pain existed before the accident, notwithstanding the fact that the man was in the mail service, had to pass a civil service examination, and was in the habit of handling heavy sacks of mail.

When these surgeons and neurologists were on the witness stand, under oath, they stated that it was "absolutely impossible for a man to have a fracture of the vertebræ or a dislocation without a cord involvement which would be manifest."

FIG. 2.

Later this man recovered, as one would expect he would with a properly fitting mechanical support.

This case is not given with intent to criticise, but rather to illustrate the prevailing opinions held in regard to injuries to the spinal column; it illustrates, too, the class of men who are likely to so regard these injuries, as the railroad employed the best talent to be had from the stand-point of knowledge and integrity.

Fig. 2 is the photograph of a man who received a fall from a height of twenty-two feet, striking on his shoulders and back. When reached by his fellow-workmen he cried out from pain,

and asked to have the block removed, which he imagined was under his back. He had full control of the rectum and bladder, could move his limbs, and complained of pain only in the back, sides, and abdomen. He never had any symptoms of paralysis, and a fracture or a dislocation of the vertebræ was not discovered.

FIG. 3.

He remained in bed several weeks. After he had been up a few days, because of continued pain in his back and sides, it was observed that there was a slight prominence of one or two of the vertebræ in the dorsal region. The condition was closely observed and the deformity found to be visibly increasing. There was no

doubt in the minds of the attending physicians that he had a fracture or a dislocation of the vertebræ, or both, without paralysis.

In another case a boy, while coasting, received an injury to the spine; he walked partially up the hill, but, owing to pain in his back, made the remainder of the way on his hands and knees, and owing to a continued pain he allowed his companions to take him home on a sled. A surgeon, hastily called, found distinct crepitus in the dorsal region and a slight deformity. When the spine was gently manipulated the rigidity of the muscles of the spine and the radiating pains were quite similar to those accompanying Pott's disease. The family physician was later called, and diagnosed it a fracture of the posterior segment, or a portion of it, without any cord involvement—quite a concession on his part, as he was one of the physicians who testified, about two years before, that in his opinion it was impossible for an injury to occur causing a fracture or dislocation to the vertebræ without having extensive cord lesions; and, further, that it would be absolutely impossible for a patient to walk immediately after such an injury.

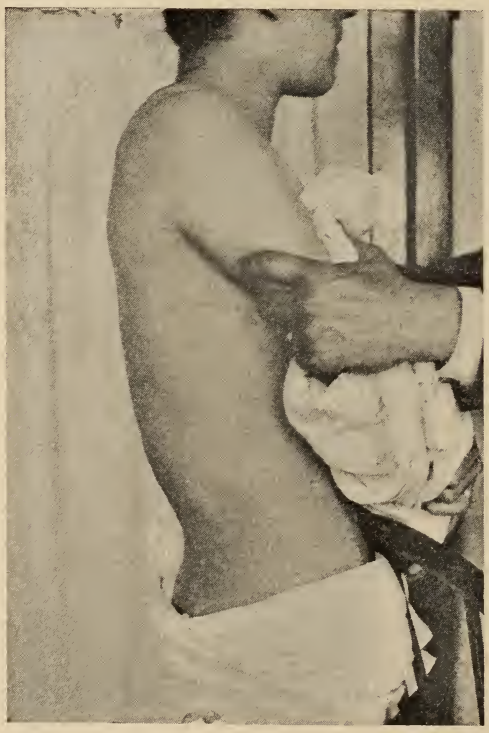
A modification of the Taylor brace was applied (Fig. 3), which he was obliged to wear for many weeks before the integrity of the parts seemed to be re-established.

The cases just reported of fracture without paralysis did not show any mark of deformity except in the case shown in Fig. 2. In this case one could unreservedly state that there had been a fracture, if not of the vertebræ bodies, certainly through the laminæ.

In this connection Dr. Sewell, of Two Harbors, Minn., gives the history of a patient, aged twenty-seven years, who was struck on the back by a fall of about a ton of iron ore, "crushing him into a heap." On examination he found "a marked kyphosis of the ninth, tenth, eleventh, and twelfth dorsal vertebræ, with multiple bruises and abrasions of the back; the chest presented a marked bulging, which could be partially obliterated on pressure, but accompanied by great pain. During the forty-eight hours following the inguinal areas became greatly discolored, and the first twenty-four hours the patient suffered great pain. During the first week a persistent cough caused considerable pain, and there was some expectoration of blood. There was never paralysis, and the patient was cured by rest in bed and a plaster jacket. The

deformity, however, was not reduced. In this case there is abundant evidence to show that previous to this injury the man had never had any deformity of the spine. This case showed that you may have a fracture of the anterior portion of the vertebræ and yet have no paralysis, a condition which no doubt frequently occurs. One can readily understand how a fracture of the anterior segment could exist and yet not decrease the lumen of the spinal canal.

FIG. 4.



Other cases might here be reported in detail where the deformity was present immediately after the fall, crepitus being distinctly perceptible, showing a fracture of the posterior segment without any cord involvement whatever.

However, the complication in injuries to the spine which has been given the widest attention is that of paralysis following injury

and the operative treatment which has clung to it; although most of the cases reported terminated fatally, they are placed on record to show the "feasibility of the operation and the ease with which it can be performed."

Now and then, since 1762, cases have been reported which have recovered after laminectomy—an operation suggested as far back as the seventh century B. C. Judging from observations in the West, no doubt every case of paralysis recovering after laminectomy has been thoroughly and completely reported, while the cases of death following the operation have, in a considerable measure, passed unnoticed.

So it has come that our views concerning laminectomies for paralysis following injury to the spine, like many other opinions we hold along this line of spinal injuries, are traditional, as are many of our views concerning the complications which cause the paralysis; for instance, "permanent compression of the cord, which can only be removed by operation;" but a permanent compression of the cord or of any part of it is a very rare event.

Hemorrhage in the canal or of the cord itself is another commonly supposed cause of paralysis, and is another indication given for laminectomy. The general impression is that this hemorrhage can be checked if continuous, or, if a clot be present, removed at the time of the operation. This, in rare instances, is true; yet in the detailed report of cases macroscopic clots are seldom reported, while in some of the very recent cases microscopic post-mortem findings showed a hemorrhage "in the gray matter of the cord" which certainly must have occurred at the time of the initial injury, and could not have been removed by an operation because undiscoverable, and if discoverable, inoperable.

In deformity of the vertebræ either the displacements from fracture or dislocation, or both, is another condition brought forward which, we are told, requires radical surgical means to remove.

In a dislocation of the vertebræ by extension, counter-extension, and pressure the dislocation can be reduced, if paralysis seems to demand it, just as well before a laminectomy as after it; the operation can in no way assist us.

In fracture of the posterior segment, with a possible displacement of the fragments so as to cause pressure paralysis, the dislo-

cation can, in all probability, be reduced by hyper-extension, except in depressed fracture; in this case the depressed vertebræ could

FIG. 5.

be drawn out by the use of stout double hooks as retractors, by traction on the spinous process, without a laminectomy. This cause of paralysis is, however, very rare, for the muscles them-

selves have a tendency to draw the displaced fragments into position as soon as the original pressure is removed.

Statistics show that the principal fracture of the vertebræ is a fracture of the anterior segment from a forcible flexion of the spine, causing a crushing of the anterior body. These statistics may not be correct, as no doubt many fractures of the posterior segment have been unrecognized because of the lack of cord involvement.

This crushing of the anterior segment is where the greatest permanent injury is done to the cord. The cord is completely or so nearly destroyed or pulpified that if not at once severed a rapid degeneration occurs. It is in this class of cases that no benefit whatever can be expected from any source, as there is no known way of grafting new cord or removing destroyed portions of it, or of grafting posterior nerve-roots into the cord below, as has been suggested.

If in this case the anterior body may be so displaced as to encroach upon the spinal cord, how then is it possible, by removing the posterior arch, to replace this vertebræ?

Those who have had a great deal of experience in the distortions of the spinal cord, in caries of the vertebræ, and in scoliosis know to what a wonderful extent the spinal cord will adapt itself to a tortuous canal. It is probably the original injury, or the inflammatory condition following these injuries, which produces the paralysis, and not so much the deformity. The deformity could be more easily reduced by extension and hyper-extension than by operation, especially as there is more or less mangling of the soft parts, thus weakening the tissues which hold the vertebræ in place.

Another condition sometimes occurring at the time of the fracture of the vertebræ, and brought forward continually to favor the operation, is the spicula of bone resting upon or piercing the spinal cord ; yet how many times this spicula of bone has been found wanting, and when present and removed, yet paralysis continue and even death follow.

In short, it has been shown time and time again, and emphasized by post-mortem findings within the present year, yet it is not fully realized, that the injury to the cord, caused at the very time of the accident, is when the damage to the cord was done—

the laceration, hemorrhage, the fibres twisted and distorted by the trauma, the œdema and inflammation following immediately, and the consequent degeneration of the cord—these are the causes of the paralysis, and an operation can in no possible way relieve the condition.

It is true that our knowledge of the localization of the cord lesion is quite accurate, and we admire those men who have devoted so much time to the study of anatomy and nerve distribution; yet men who have operated on many of these cases—men like Thorburn and Kocher—warn us of the danger of operating too low, and the wisdom of their warning is manifest in reading detailed reports of cases. With all of our theorizing it is a fact that the symptoms in no way show what the focal lesion may be.

Another general impression is that the operation is an easy one to perform and void of danger other than sepsis—the latter hardly to be considered to-day. The operation is not an easy one, either for operator or patient. The operator finds, when he comes to dissect through the layers of the muscles of the back, that it is a long way before he can make a clearing to the lamina; and when in the lower dorsal and lumbar regions, there to gain access to the neural canal is a most troublesome procedure. The hemorrhage is many times very perplexing and troublesome, and in order to check it the vessels must be tied or the oozing checked by pressure, and the hemorrhage might be microscopic.

As to the patient, the shock must be considered. As he is in a very poor condition physically for the operation, the necessary manipulations are likely to add to the irritation of the cord itself, not to mention the immediate and after-effects of the necessarily prolonged anæsthesia.

Treatment. After a fall or injury to the spine, and when pain and stiffness reach a considerable degree, rest on a stiff bed is very imperative. If the pain and rigidity continue for some time a brace should be applied or a plaster cast adjusted; in children is this especially true, owing to the danger of the trauma becoming tuberculous. In fractures and dislocations, and in cases where extreme disability occurs, very radical measures should be taken, not necessarily operative.

To illustrate : In the City and County Hospital of St. Paul was a case of injury in a woman who had jumped from a considerable height with suicidal intent. She had exaggerated knee reflexes, ankle clonus, vesicorectal involvement, a distinct bulging in the lower dorsal spine, and considerable ecchymosis of the back. The general surgeons thought it an excellent case for operation, while from an orthopedic stand-point it was a case for extension and immobilization ; the latter was permitted on trial, especially as the patient experienced immediate relief from pain when manual, forcible extension of the legs was made during the examination. Slats were placed in the bed to prevent sagging of the mattress, the foot of the bed being raised and a ten-pound weight attached to each leg by a Buck's extension.

The relief from pain was immediate and continuous, before extension it having been necessary to control the pain by morphine ; in less than twelve hours the patient had full control of the rectum and bladder. Later a plaster-of-Paris cast was applied and the patient allowed up. After a time a Taylor brace was applied. Aside from a slight deformity the patient is now perfectly well. (See Fig. 4.) Another case was that of a young man, aged twenty-seven years, who was brought to the same hospital, having been injured in a railroad collision. He gave the following history : A car or engine collided with the one in which the patient was lying, the force of which threw his head and body against the end of the car. He experienced complete paralysis of the body except the muscles of speech. He requested his companions to pull his head, which was in an extremely flexed position. When the traction was made the head suddenly seemed to be replaced with a decided snap ; he felt much better, gained a little use of his muscles, and lost some of the sensations of numbness. On examination there was no deformity, bruise, or abrasion on the body ; he talked freely, but with apparent thickness of speech.

Pupillary reflexes were normal ; there was exaggerated knee reflex and ankle clonus present on both sides, more exaggerated on the left. The left leg and foot were thrown into a clonic spasm from the slightest touch on the foot ; there was no deformity or crepitation in the cervical region, but extreme tenderness ; pressure on the fifth to seventh cervical and first dorsal spines threw both

legs into clonic spasm. Urine was drawn by catheter; the temperature was 100° F. Weight and pulley extension from the chin caused the pain to almost immediately disappear, the tenderness in the neck diminished, as did also the paralysis, in a few days, and the exaggerated reflexes entirely cleared up.

It is impossible to state what the exact lesions were in this case, but the treatment and result being diametrically opposite to that received in the case now to be reported, represented in Fig. 5, leads one to infer what the result might have been had not the attending physicians been so anxious to reduce a diagnosed dislocation of the vertebræ under anæsthesia. The history of the case represented in Fig. 5 is complete, but the details are repetitions; it is only necessary to state that by a twist of the neck and a fall the man was completely paralyzed, a deformity in the cervical region being very apparent. The patient was anæsthetized, his head extended and manipulated, and manipulated without being extended, and then he was allowed to recover from anæsthesia, and died in a short time. This specimen illustrates most emphatically how a manipulation in this fracture would simply shear the cord right off, and it is quite likely this is what occurred in this case while in the surgeon's hand under anæsthesia, as the injury was a slight one to produce so extensive a lesion. If extension weight and pulley from the chin had been applied immediately and continued there is little doubt but that the man would have recovered, as a few pounds of extension in the pathological specimen completely restored the lumen of the cord. This specimen illustrates, too, how impractical an operation would be, as the fracture permits the pressure from the anterior segment—a condition an operation could in no way relieve, even if accessible. The case above referred to, and represented in Fig. 1, was a case of paralysis following an injury in which there was no deformity present, the seat of the paralysis was located and a laminectomy performed, the patient subsequently dying. At the time of the examination, prior to the operation, considerable extension of the legs was made, and the patient exclaimed, "I am now free from pain." It was suggested that this be his treatment, together with fixation of the spinal column, but the general surgeon's desire to operate prevailed, with the usual death following. Post-mortem showed simply the

torn ligaments; to the naked eye there was no visible injury to the cord or its membrane, or any evidence of there having been pressure; but, with the microscope, were found hemorrhages and clots in the cord.

Complete immobilization should be the surgeon's aim not only because it places his patient in the best position for repair, but because it checks the tendency to increased irritation, this irritation causing an increase in the hemorrhage and a further laceration of the cord; it also relieves the patient of pain and meets, to a certain extent, all of the indications and complications heretofore cited.

When an orthopedic surgeon speaks of immobilization of the spine he does not mean what is usually implied in such an expression as "rest in bed," a term frequently used in general surgeries; he means complete and thorough immobilization. This can only be obtained by recumbency, with extension and counter-extension, the patient being placed on a hard surface; not in an ordinary bed with yielding mattress and springs, allowing the patient to move from side to side, every twist and turn causing motion between the vertebræ, and adding still further damage to an already injured spine or cord.

Many times these patients are rolled back and forth in bed for examination, the reflexes sometimes being so exaggerated as to jerk the entire body, the patient crying out with pain. When placed on a water-bed, with every movement of hands, shoulders, or head, the entire body is set in motion, causing pain and adding still further to the injury; yet in every hospital the water-bed is brought out for the fractured spines to prevent the bedsore, which is, of course, neuropathic, and if there is anything in keeping the spine quiet to improve the conditions causing the paralysis, certainly the water-bed is the very thing which ought not to be used.

In watching a patient on a water-bed or on an air-bed, it is hard to understand how they prevent any more pressure than a hard bed, as it seems impossible to so accurately fill them with air or water as to make equal pressure on all parts of the body, and the weight will be on the projecting bony points, which can be better protected if the patient is lying on an unyielding surface, each projection being protected by rings or rubber cushions. We know from experience that sores do occur when patients are on

water-beds. If the patient were placed upon a frame like the one in Fig. 6—a steel frame with canvas stretched across it, simple in construction—it could be carried from place to place, evacuation of the bowels could take place, and the patient could be cleansed with little if any motion of the spine.

If the surgeon had an irresistible impulse to operate the patient could be carried on this frame to and from the operating-room with less friction at the seat of fracture or injury.

Since the orthopedic surgeon has learned how to treat caries of the vertebræ, paralysis from Pott's disease is a rare affection, laminectomies and operations to relieve the paralysis are seldom necessary, and the prognosis is extremely favorable. We have learned that the ideal treatment is recumbency, with extension.

FIG. 6.

Bradford's bed frame (Bradford and Lovett).

Our experiences along this line should make us more enthusiastic than the general surgeon in this treatment for injuries to the spinal column, as he does not realize how much can be accomplished by proper rest. Immobilization should further prevail, for while the surgeon, anxious to operate, is searching for the now and then case which might be so relieved by the use of immobilization as an adjunct, he is in no way lessening the chances of the many who would get well without an operation.

Whether laminectomies are ever necessary, whether spines so injured should ever be operated upon, are mooted questions.

With various operators holding such varied opinions we are certainly justified in questioning if, from our present knowledge, an operation is justifiable. Of one thing we are certain—the mechanical or orthopedic treatment has much to commend it, not only from

favorable reports in which this treatment was exclusive, but even in cases operated upon; before, during, and after the operation the great benefit reported from immobilization emphasizes its value.

Much is hoped from the X-ray, for while it may not show us the condition of the soft parts, especially the nerves, it will be of service in the bony complications, and thus save many a case from the operating-table.

We regret the death of Bernard E. Brodhurst, of London, who, although not an active member, as a corresponding member made a number of valuable contributions, and, for those of us who did not know him personally, these acquainted us with his scientific ability.

During the early part of this year word reached us of the death of Lewis A. Sayre; then followed his obituary in all the prominent medical journals and in many of the lay press as well. There need be nothing further here recorded than that we mourn the loss of an American orthopedic surgeon whose name will always be associated with orthopedic surgery, and especially with its early history.

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# ACUTE TRAUMATIC COXA VARA AND INCOMPLETE FRACTURE OF THE FEMORAL NECK.

By NEWTON M. SHAFFER, M.D.,
NEW YORK CITY.

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Dr. Shaffer presented a boy, aged fourteen years, who one year ago had fallen, while "skylarking," and had struck his hip against the sidewalk. This had been followed by pain, limping, and some disability. Little attention had been paid to it until last Christmas, when he had been thrown during a wrestling match and had fallen, again violently wrenching his hip. From that time there had been great pain, disability, and progressive shortening. He had been referred to the speaker last spring. Examination showed the classical position of fracture of the neck of the femur. The limb was rotated outward; there was a good deal of pain, marked muscular limitation of motion, and there was one and one-quarter inches of shortening. Any attempt at motion caused pain. An X-ray picture showed an incomplete fracture of the femoral neck, with a distinct coxa vara neck. It was impossible to extend the limb at that time, and owing to the amount of abduction it had been difficult to apply a straight apparatus. However, with a proper traction brace the condition had markedly improved and the shortening had been reduced. Pain was relieved at once, and the range of joint motion greatly increased. The foot-piece of the brace has a limited action; it has an automatic "snap" at the knee and a traction-rod at the upper or femoral portion. In these cases of acute traumatic coxa vara not amounting to a complete fracture he firmly believed in the utility of traction and protection as shown in the apparatus presented. The angle of the shaft of the apparatus just below the hip band should be gradually changed to overcome the adduction. He expected to

secure in the conditions presented a useful limb, a good position, and practically normal motion of the joint. He had reason also to expect a further reduction of the shortening, which now amounted to three-quarters of an inch.

Another patient, a boy aged fifteen years, whom he had seen three years ago, presented an almost similar history, the same position and symptoms, with one and one-half inches of shortening. No X-ray was taken. The boy remained under observation for about a year, during which time the shortening was reduced just one-half, *i. e.*, three-quarters of an inch. The treatment was the use of the "Campbell brace"—the one used on the patient presented. Pretty constant traction was used, with adhesive plaster at times, at others without it. After about one year's treatment the patient left town and was lost track of. In this instance, however, the joint functions were nearly normal. The patient walked without a limp, and a good result, with some shortening, seemed very probable.

These cases, with others, make it apparent that we may look for good results and a modification of the bony shortening in especially adolescent subjects.

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## DISCUSSION.

Dr. Gibney said that he had been deeply interested in this case because of the statement that the case presented practically a traumatic coxa vara, with a good deal of reflex spasm about the hips. Dr. Shaffer had stated to him that he had been able to correct the rotation outward and control the spasm sufficiently well to restore the function of the limb without resort to osteotomy If this could be demonstrated it would seem to him an exceedingly valuable method, and certainly the case apparently supported Dr. Shaffer's claim for this treatment.

Dr. R. H. Sayre said that he had seen cases of coxa vara occurring quite suddenly in adolescents who were apparently rhachitic. He had applied traction in bed in one case, the limbs being crossed. The bones had been sufficiently soft to allow of

the desired correction. However, while lying in bed a lateral curvature, which had been only very slight before, had become quite prominent.

Dr. Whitman suggested that this case might have been induced by traumatism. He thought sometimes that what was called simple coxa vara was really a partial separation of the epiphysis. No apparatus like that presented could ever cure the patient in the sense of rectifying the position of the neck of the femur; for if the deformity were really there it could never be overcome by simple traction, even if it were constantly applied, although its progress might be checked and the symptoms relieved. However, the results might be made successful by a cuneiform osteotomy. He had recently seen three cases upon which he had operated by this method, and in all there was absolutely no trace of the deformity; and in one case the limb, after two years, was slightly longer than the other. In the adolescent type, in which there was usually backward displacement of the neck, as shown by extreme outward rotation, he thought linear osteotomy was equally efficient.

Dr. B. E. McKenzie asked why Dr. Whitman used a cuneiform osteotomy here and not in bowlegs.

Dr. Whitman replied that he did this because it gave a more accurate result. With a simple osteotomy it was somewhat difficult to control the fragments. The operation which he does by the cuneiform method does not entirely separate the bone, but a hinge is left on the inner side; thus the possibility of sliding by of the fragments is avoided.

Dr. A. M. Phelps, of New York, said that about six years ago this subject had been thoroughly discussed at the New York Academy of Medicine. The speaker said that he had found that when he did a linear osteotomy the muscles acted as a fulcrum and separated the fragments one from the other; hence he had adopted the cuneiform osteotomy. He had presented some of these cases before the Academy at that time.

Dr. Sayre said he saw no reason why, if the coxa vara were the result of an acute softening, it would be any more difficult to make it straight than in the lower end. He had succeeded in bending a very bad knock-knee in a boy of fifteen into a straight line. If the bone were hard it should be cut; but if soft, why not bend it?

Dr. Whitman said it was easy to straighten a deformity at the knee, because one could apply the necessary leverage. The neck of the femur was in childhood less than two inches long, and it was impossible to apply direct force with the aim of correcting deformity except in the manner that he had suggested—*i. e.*, extreme adduction. He doubted if it were practicable to overcome a deformity like genu valgum even by continuous traction, and how could one hope to elevate the neck of the femur by the feeble traction that could be exercised by an ambulatory support. The effects of the deformity—the discomfort, the muscular spasm and retraction—might be released by this means, but hardly the underlying deformity.

Dr. Sayre said he saw no difficulty in bending it any more than there was any great difficulty in fracturing an ankylosed hip. He would pull in the direction of abduction.

Dr. Frank E. Peckham, of Providence, said that he had a case of coxa vara in which the work of an ordinary traction hip splint had apparently effected a complete cure after about one year. The legs were now practically of the same length, and the boy was walking without a limp.

Dr. Shaffer said that his patient's leg had been lengthened about half an inch within the past few months. He had several other patients with similar histories who had apparently perfectly good legs. Dr. Whitman was in error, he thought, in supposing this was a separation of the epiphysis; it was between the trochanter and the epiphysis. The softened bony parts can be elongated just as any other soft part may be elongated by traction. This limb had lengthened very decidedly. There is reason to hope that it may be made still longer.

Dr. John Ridlon said he had treated one case of unquestioned coxa vara by traction apparatus acting in this way. While wearing this apparatus the coxa vara and the shortening had not increased, and after a period of two years and a half the apparatus had been removed and the coxa vara had increased. He had treated fracture of the neck of the femur in a boy, aged eleven or twelve years. It had been put on within four weeks after the injury, under the supposition that there was not solid union. The length of the leg had not been increased in this instance. From this experience he was positively of the opinion that a traction apparatus applied to the case of coxa vara would not increase the length of the leg, and if applied to a fracture of the neck of the femur in a child would not increase the length after the fracture had existed a few weeks. He was willing to admit that such treatment would remove pain and disability and apparenly make a leg longer, but it was impossible to believe that the bone was actually lengthened and the limb actually strengthened unless there was afforded in proof two good radiographs made by the same person showing the first and last condition. The flexion and adduction and rigidity coming from the joint inflammation were relieved by the apparatus, just as in cases of ordinary inflammation of the hip.

Dr. Shaffer said he regretted that he had not brought the X-ray picture with him; he would have done so had he known beforehand that the case was to be presented.

# NEUROSES AS SEEN IN ORTHOPEDIC PRACTICE.

By B. E. McKENZIE, B.A., M.D.,
TORONTO.

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A CONSIDERABLE number of affections clearly related to the nervous system and manifested by disturbance of functional control are not marked by changes in the central or peripheral nerve structures as yet discovered. These conditions have been recognized and are referred to as neuroses. It has caused surprise to know how largely these conditions force themselves prominently into consideration in many of the cases occurring in orthopedic practice.

In this class of patients the spine is the part most commonly complained of ; there is no joint or part of the body, however, which may not be named as the seat of the supposed disease. It is not my purpose in this paper to discuss the admittedly difficult subject of neuroses exhaustively, but to report some striking examples and to describe especially one method of treatment which has been found successful.

CASE I.—L. D., aged twenty-two, a farmer's daughter, said that she had been unable to work for six years, that she had suffered with pain in the back and head and inability to exert herself, that for three months previous to consulting me she had been unable to help herself, and that her mother had been an invalid for ten years and was said to be suffering from "spinal disease." This young woman was brought to my office in the ambulance, having been brought from her home to the railway station in the country on a stretcher. Upon my requesting her to disrobe that I might examine her spine, her aunt said that she was unable to stand or even to hold up her head. By insisting upon her doing as I re-

quested, she did stand up for examination. I was unable to find any evidence of organic disease. She was of good color, though perhaps rather pale; muscles well developed; a fair amount of adipose tissue. She was symmetrically built, and her heart and lungs were normal and acting slowly. I assured her father and aunt that she had no serious illness, but that I could not consent to take her under my care except on the condition that she be left in the hospital absolutely under my direction, and that I could not allow her to make or receive visits. These conditions were at once agreed to, and within an hour of the time when she came into my office she walked up two flights of stairs to a ward in the hospital. A few days afterward she was taken into the gymnasium an hour each day, and work at first light, but increasingly difficult, was given until she was able, with other patients, to do all that was required of her. Treatment was continued for a period of six weeks, care being taken to increase constantly the amount and the difficulty of the work done. At the end of the time she was spoken to very plainly regarding her condition and tendencies. She returned home, and has now for more than a year and a half continued well and is working hard.

Case II.—E G., aged eighteen years, rather anæmic and of nervous manner. At fourteen years of age she complained much of headache, backache, and general lassitude, so that she was kept from school most of the time. During the four years that have elapsed both she and her family have considered her unable to work; and during this time she has been examined by a gynecologist, who removed one ovary; an orthopedic surgeon, because she was lame and believed to present symptoms of hip disease, who assured the family that she had no joint affection; and a neurologist, who said he believed her condition was one of hysteria.

At the time of examination, in April, 1900, I found her very lame. Her limp, however, was very different from any that I had ever observed. Though she had walked with marked lameness for some years, yet there was no evidence of any inflammatory condition of any joint or of other lesion, and but very trifling atrophy. The only possible organic cause which could be found upon examination was a foot considerably pronated. Whenever

any part of the leg or foot was touched, however lightly, the entire limb was thrown into violent and erratic convulsions (I do not know what better term to use, so irregular and so extreme were the excursions of the limb). She had a systolic murmur; otherwise there was no evidence of organic disease. I expressed the opinion that the case was one of hysteria, and advised that she come to the Orthopedic Hospital, in order that she might be completely under control. Very definite and precise instructions were given to the directress of the gymnasium, to the effect that whatever work was assigned must be done with great care, beginning with the simplest forms and movements, calling gradually into exercise each individual extremity, and seeing that excuses were not accepted in place of work. This course was pursued during the month of June, frequent observations being made, but disclosing no real cause for her lameness except the undue pronation of the foot. This, I am disposed to think, was acquired, having arisen from her manner of walking for so long a time. She proved a very docile girl, but was ready on the slightest provocation to burst into hysterical weeping. At the end of the month her limp had almost disappeared, her health and color had greatly improved, and she had been taught to place the unduly pronated foot and walk with it in a correct position. As she was to return home to her mother at this time, I entertained fears that she would relapse during the two months which must pass by before she could come back to her work in the gymnasium. Careful instructions were given to her mother and to her medical attendant, which were scrupulously carried out, in consequence of which she returned in September, showing that improvement had continued. The instructions were to the effect that the girl's attention must not be allowed to centre upon her own troubles, but that she must be assured that her complete and permanent recovery was in certain prospect and that she must learn to rely upon herself.

On her return to the hospital, in September, she was subjected to the same discipline as formerly for four months, at which time she had very greatly improved, and could receive ordinary massage without manifesting any reflex movement in the limb, which formerly could not be touched even with a feather without manifesting the most exaggerated reflex movements. In her gymna-

sium work special care was taken to have her take exercises demanding the balancing upon each limb alternately, also the alighting upon the feet from a height, as in vaulting, and in suspension by the arms, etc. These she soon learned to do without experiencing any inconvenience and without the appearance of reflex movements in the affected limb. Considerable difficulty, however, was found in teaching her to run. She was taken out upon the lawn, and with her classmates was engaged in various games. Considerable ingenuity was required to get over the apparently insuperable obstacle presented by running. The quick movement from the sound limb to the affected one appeared to give her a sudden spasm and to block for the moment any further progression.

Perseverance along this line, and the full engagement of her attention and the arousing of interest in the games, finally overcame even this difficulty. Her color and general health were much better, and since her return home she has assumed the duties and responsibilities of the household. Only a few days ago her medical attendant wrote me saying that her condition had continued to improve. It is now about six months since she left the hospital. Her lameness has almost entirely disappeared. There is simply a noticeable lack of symmetry in walking, so slight that an ordinary observer would scarcely perceive the defect.

Case III.—M. D., aged twenty-nine years, who three years ago had a carbuncle situated near the coccyx. In giving her history she spoke of "abscess of the spine," and said that some bone came away after the incision. The patient is tall, has very slight muscles and a poorly developed chest, but is of good color, and presents no evidence of tuberculous disease. The cicatrix shown upon the spine does not indicate that there was anything more than a small carbuncle. During three years, however, she has worn jackets and braces, has been advised change of residence for her health, etc. She was referred to me in order to have a brace applied before leaving for travel abroad on account of her health. Her invalidism continued up to the time when I saw her, in May, 1900. She then complained greatly of pain in the spine, and said that she was unable to work. She was immediately sub-

jected to the usual discipline of the gymnasium, with results as gratifying as in the former cases.

Case IV.—B. W., aged eighteen years. Had typhoid fever in January and February of 1898. On her recovery from the fever it was found that she was unable to walk or even to stand; consequently she was taken about in a wheeled chair, from which she was carried again to her couch or bed. This condition continued until I saw her, in June, 1899. At that time she presented the following conditions: A rather tall and obtuse-looking girl; knees flexed, and could not be extended to more than 120 degrees; feet in a condition of equinus, the plantar surface being at an angle of 120 degrees with the axis of the leg; muscles symmetrically atrophied; slight disturbance of sensation. The case was believed to be one of multiple neuritis following typhoid fever. The recovery from this condition is generally satisfactory; hence a favorable prognosis was given. The deformities were easily corrected. During the subsequent months much difficulty was experienced in re-educating the patient to walk. She had already been informed by a number of physicians that she would be a cripple throughout life, and was so fully convinced of this that her lack of co-operation in the efforts made proved quite an obstacle in the way of progress. She was at first held up by the arms, and her feet and limbs were moved for her. This exercise was frequently repeated until she began to put forth some voluntary effort. Subsequently she reached a point where she could walk by the aid of crutches. She was then subjected to regular class work in the gymnasium, being allowed to stand supporting herself against the wainscoting, which extended as high as the window-sill. Gradually she was led on from one point to another, it being necessary at every step to direct her will and to urge her forward to renewed effort. It was only after she had acquired the power of moving about independently with considerable security that she seemed to recover some brightness and to manifest willingness to co-operate in the efforts being made. When she had regained the power of moving about so as to take care of herself she was not allowed to return to her father and mother, who were aged and unwisely sympathetic, but was sent to live with a brother, who was carefully instructed

how to deal with her. He found her employment in a factory, in which she continued to work, making her own living, and making constant improvement until her recovery has become complete.

Case V.—N. M., aged twenty-one years. For some years she has been a source of anxiety to her family because of ill-health, which, upon cross-questioning, seemed but indefinite in character. She had been subject to various spells and spasms. Upon physical examination no organic disease was found. She was brought to the hospital with the understanding that she was not to be visited by her friends or allowed to return home. Subjected to the usual discipline, she became unconscious on one occasion in the gymnasium, but without using any efforts to restore her to consciousness she was ordered to be carried into the adjoining room, where she was left for about two hours without any attention being paid to her further than sufficient to satisfy ourselves that she was in no danger. At the end of that time she was spoken to sharply and told that, as it was tea-time, she must at once get up and have supper. She responded to this. Only once subsequently was there any manifestation of this kind. While under treatment she improved in general health, became very robust, athletic, and cheerful, and returned home in good health and spirits, and has so remained.

Case VI.—F. S., aged twenty-three years. This girl presented a slight lateral curvature of the spine, also round shoulders, and complained of pain in the back and side. She had been unable to work for some years, and had been the subject of considerable anxiety to her family. She, too, was subjected to the usual discipline of the hospital. One one occasion, while participating in the regular work, she was seized with a trembling fit, and word was sent to me that she was having spasms. Instead of going to her I sent word that her work must be continued; that the spasms would do her no harm. Once subsequently, under somewhat similar conditions, she was treated in a similar way by the director who had charge of the gymnasium work. The improvement in her general health and the disappearance of the pain in the back and side were accompanied by an increased alertness and

willingness to participate in all the general exercises and games. She returned home, having entirely regained her physical vigor, and from a recent letter we learn that her favorable condition continues.

CASE VII.—H. J., aged eighteen years, had a sprained ankle several years previously, and was laid up for some weeks from that cause. A history was given of indefinite pains in the knee suffered at various times. She had had plaster-of-Paris applied and had kept the leg bandaged much of the time. For several years past she had never been entirely free from lameness. When first seen she could walk only a short distance, using crutches sometimes.

Examination revealed no organic disease in the limb, but there was considerable atrophy. She was allowed to use a light brace for a short time, but was assured that she suffered only from weakness, which could be cured so that she could leave off her brace. All bandages were removed, massage was given daily, and also, in gradually increasing amount, exercise was given in the gymnasium. The limb rapidly increased in size, the lameness disappeared, and recovery was complete and permanent.

CASE VIII.—E. D., aged thirty-four years, a tanner, whom I saw in September, 1900. While he was engaged, three years previously, in pulling down a lever pressing down hides, something gave way, allowing the patient to fall upon a truck, the sharp angle of which struck him over the ribs about the mid-dorsal region and at the left of the spine. No fracture was found, but much complaint of pain was made. After a few weeks the patient recovered sufficiently to be about, but professed to be unable to return to work. He had remained in this disabled condition during the three years, himself and his family being supported by contributions from kindly disposed neighbors, from societies, and from the municipality in which he lived. When I first saw him he was standing erect, but when he was disrobed for examination there was observed a peculiar spastic condition of the back muscles, and he professed to be unable to bend forward or to either side to more than a very limited degree. There was also inability to

move the right scapulohumeral joint. Subsequently, when he came to my office, he was walking bent forward about 45 degrees from the erect attitude. This man was anæsthetized and his spine fully extended, and a plaster-of-Paris jacket, extending from the trochanters to the chin and occiput, was applied. He was allowed to be about the wards freely in a day or two afterward. No reaction was experienced. While he was under anæsthesia it was forgotten that the shoulder was ankylosed, but upon being around the wards after the plaster jacket was applied he expressed his great delight at his improved condition and at the free movement which he had in the shoulder. He was not informed that nothing had been done to his shoulder, but he was encouraged to use it freely. On the removal of the plaster-of-Paris jacket he stood erect and moved very briskly. This continued for the space of about a month while he remained in Toronto. On his returning to his home, I have learned, a relapse occurred.

Case IX.—B. H., a girl, fifteen years of age, whom I found in bed looking healthy, bright, and well-developed. She was the daughter of comparatively wealthy parents, and her mother evidently was over-indulgent. For an indefinite period, probably two years previously, she had been unable to make any considerable exertion, and for some months had not been able to walk more than one block without having pain in her hip and back. On examination I found no evidence of disease in any joint. There was a very slight postural lateral curvature of the spine. She said that she was free from pain when lying down, and that it was only upon exertion that pain came on. In consequence of this very definite history, which had extended over a long period of time, I refused to make a positive diagnosis on my first visit. Examining on a second occasion, several weeks later, I found the same conditions present. I then made the diagnosis with a good deal of confidence which I had been disposed to make in the first instance—namely, that it was simply a neurosis.

In September last, several months subsequent to my first examination, the girl came into our gymnasium, and has remained with us during the year. The time not necessary to be spent with us is spent at a young ladies' college. For several weeks after

going there she made a good deal of complaint and had the meddlesome sympathy of the teachers and principal. I found it necessary to speak in very positive terms concerning this matter, assuring them that so far as her physical well-being was concerned she was entirely under my charge, that I held myself responsible, and that I must insist upon their carrying out the regulations which I had laid down for her if she were to remain in the college. The lady to whom the authorities of the college looked in regard to matters of the girls' health came to see me personally, and, finding her a very intelligent and reasonable woman, I had little difficulty in securing her intelligent and hearty co-operation. Since that time we have had clear sailing, and the girl has, during the year, developed into quite a vigorous athlete. She is in the best of health, and has unbounded confidence in her own ability to take part in any game or to do any work. No complaints are heard from her regarding pain or disability.

Let the recital of these cases serve to call attention to the work done in the Orthopedic Gymnasium so far as it is employed in the treatment of neurotic patients. The principles of treatment employed are not new; the means used in applying these principles have not received much attention. In order to succeed in the management of these cases a prime requisite is a positive diagnosis. A line of conduct which evinces uncertainty and vacillation is fatal to success. The line of treatment to be adopted should be well defined in the mind of the surgeon; his instructions to assistants should be definite, and no trifle should induce him to allow any departure from the prescribed regimen. While the nature of the work to be done and the mode of life to be followed are very important, yet the spirit in which these directions are enforced is of still greater importance. It is essential that the patient form the impression and attain to the firm belief that the surgeon is thoroughly master of the situation. It is not sufficient to accomplish this to use strong words and confident assertions. His conduct must bear out his professions.

The Weir Mitchell system of treatment marked a great advance in the management of such cases, but it is essentially passive; the active element is wanting. The patient is acted upon by drugs,

diet, and massage, by the will power and force of character of other persons; but little is done to call out, to educate the volition of the patient. She is kept in bed, secluded from friends who would show an unwise sympathy, fed well, and given massage and rest. In fact, rest is made such a prominent feature of the treatment that his plan is almost always spoken of as the "rest cure." It falls short, inasmuch as it is but negative in character. Systematic training to self-reliance and renewed confidence are needed to render the cure effective. Though the patient should seemingly regain health, it is soon found that life is not a negation, but that its problems must be grappled with in a positive manner and solved. Massage, good diet, etc., are important, but in order to establish permanent results the volition must be called into exercise. It is not maintained that the special movements performed in the gymnasium have any specific influence in the treatment of these cases. It is absolutely necessary, however, that an accurate diagnosis should be made, and that everyone who is concerned in directing the treatment of the patient should be imbued with the most implicit confidence that the course pursued is a wise one and must be followed out with regularity and system.

We have in charge of the gymnasium a woman of good judgment, of tact and firmness, who follows out strictly the directions which are given. Taking these patients into the hospital whenever this course is found practicable, we obtain control of their lives and do not allow any trifling matter to stand in the way of carrying out whatever regulations are deemed important. We obtain a very absolute control over their doings for a considerable length of time, and thus help them to act with good common-sense until they have been enabled to see the folly of their former course and become inspired with confidence that they can conduct themselves in a rational manner. The training, continued regularly every day, affords us an opportunity to exercise the necessary discipline to bring into exercise and co-ordination the faculties and powers tending to produce rational behavior in a healthy individual.

The work done in our gymnasium, commenced ten years ago, did not have at first any such object in view, but as patients manifesting more or less neurotic tendencies presented themselves

for treatment because of curvatures of the spine, flat-foot, etc., it was observed that the systematic control which we were able to acquire in these cases was of marked value; and further observation seems to warrant the conclusion that it is one of the most successful methods of exercising the influence and discipline necessary to restore these vacillating individuals to a condition of normal health and volition.

The neurosis may not be the only, and possibly not the chief, disease present. If there is cardiac disease, indigestion, anæmia, flat-foot, curvature of the spine, or any other abnormal condition, it should receive the most careful attention, and its removal or improvement will do much to further the attainment of the object here under consideration. The one word which expresses more than any other the dictum of treatment is discipline, not only the discipline which calls for submission, but that which succeeds in educating the patient to be self-reliant, not simply to follow directions given by another, but to exercise her own judgment and to become possessed of the conviction that her powers are subject to her own will and may be made to yield, not an erratic, but an intelligent obedience.

In seeking to attain these objects, I consider class-work of much more importance in the gymnasium than individual work. It is true that each individual must be dealt with as a unit and must be studied as a special problem; it is also true that the best effects in an educative way can be obtained when the stimulus of emulation can be used. With these patients, example and surroundings count for much. The sympathy expended upon them must not be a mere matter of emotion, but must be an intelligent sympathy, which has for its object the gaining of the patient's confidence in order to accomplish a more definite and a worthier end.

In the direction of this work a field is opened requiring great tact and good judgment. For the attainment of the object in view I have not found any means which I can employ more successful than the drill, the discipline, and the development which may be secured in the gymnasium.

# A NEW AND RAPID OPERATION FOR EXCISION OF THE HIP-JOINT.

By F. B. DOWNS, M.D.,
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My attention was called by Dr. A. M. Phelps to the Deyon instrument, which was originally intended and is principally used for the purpose of forming a new or enlarging a deficient acetabulum in congenital hip-joint dislocations, and he suggested at the time that it could be used likewise for excision of the hip-joint. I tried it on several occasions for the latter, and was so much impressed by its suitability to the work that I concluded to present a paper on the subject. I have since learned that Dr. Phelps has already written an article on the subject, which I understand was published in the *Medical Record.*

To me it has always been a difficult thing to determine just when to excise in hip-joint disease ; but, as a rule, I would be inclined to say, " operate sooner rather than later." At all events, whenever I have had a patient under observation for some time I have always regretted any delay that was allowed to take place. Of course, the majority of cases are seen for the first time in hospitals, when the disease has advanced so far as to leave little or no room for doubt as to the advisableness of an immediate operation; and it is to such cases that my remark about preferring an early operation principally applies. In cases we meet with in private practice I think it might be well to distinguish between the rich and the poor. With the poor an early operation is demanded to save years of treatment and years of neglect. With the rich many joints may be saved by careful watching and constant care, though it is equally true that no inconsiderable proportion are only saved for greater disease destruction.

Operation is demanded in every case where abscesses have formed, in order that we may be able to explore the joint and diagnosticate the extent of the disease; and also to permit of drainage, the prevention of burrowing of pus, and the destruction of a large amount of surrounding tissue. A free incision having been made for the purpose of introducing the finger and exploring the joint, excision should be effected whenever it is apparent that extensive bone disease has been in progress involving the head and neck of the bone. It should always be performed when the acetabulum is diseased and the epiphyseal line is involved, even when the head and neck are normal. Excision of the head and neck of the bone would be wrong without removing the great trochanter. Complete drainage could not take place so long as any obstacle remained between the seat of the disease and the outlet. It may be added that excision is indicated earlier in the case of weak and feeble children, and always when there is a rise in temperature showing dual inoculation and when caries and necrosed bone are present.

After making your incision and exploring the joint and being forced to the conclusion that excision is necessary, you will find that an aspiration will never reveal the extent of the disease. What, then, is the best method to pursue? And this brings me to the subject of my paper.

The first step after the decision to excise is to make a curved incision downward over the great trochanter from two to three inches in length and extending down to the capsule, which, if not ruptured, will probably be found densely extended, and when it is opened pus will often be shot out or thrown from it to a considerable distance. This incision is made small, and a peculiar advantage of the Deyon instrument is that it only lacerates a minimum amount of the tissue through which it passes. After this incision has been made the head of the great trochanter is removed with a chisel, and the Deyon instrument is placed on the bone, which is bored completely through—that is, the instrument goes through the head and neck of the bone into the acetabulum. The acetabulum is then reamed out, and all the disease having been removed the bone is left in a smooth and healthy condition. Should the disease extend down the shaft of the bone

the femur may be pushed out through the opening, and all of the disease found in the femur removed by a scoop or otherwise. It will be found that so insignificant an extent of laceration has been caused that there has been very little or no hemorrhage, and only a very slight shock to the patient. This is the quickest way of which I know by which dead and diseased bone can be removed, the operation very rarely requiring over ten minutes.

After all the foreign material has been removed from the joint a large drainage-tube should be introduced and pressed down to the bottom of the opening. I usually take one of the small glass chimneys that are used for Argand burners. They are somewhat smaller than the Deyon instrument, and should be of a length to extend only to the external opening, or so that the skin and superficial fascia will fold over the outlet sufficiently to keep the tube in place. These drainage-tubes may be replaced from time to time by smaller ones, and my experience with them is that the period required for healing is much shorter than by any other method.

As a consequence of the shortness of time required for the operation, the smallness of the incision, and the small loss of blood, the shock to the system is correspondingly diminished, which is of great advantage to many of the very weak and exhausted patients upon whom we are called to operate.

I record here the case of a girl, aged seven years, who was operated upon by the method described two months ago. Before that she had been in some New York hospital, where she had received the usual treatment for hip-joint disease in the early stage, and from which she had been sent home wearing a brace. After a time she began to complain of pain, and the usual symptoms of inflammation, including rise of temperature, were observed, showing dual inoculation. There was also a loss of appetite and a condition of failing strength and general vitality. I put her to bed, with extensions, which overcame the pain to a considerable extent, but the elevation of temperature, loss of appetite, and general failing health continued to such an extent that I decided to excise the joint. There was evidence of an abscess in the capsule, but the capsule had not been ruptured. I made an incision in the manner already described, and then proceeded with the

operation according to the same technique, the child being under anæsthesia less than a quarter of an hour, and the operation itself only occupying ten minutes. There was only a very small loss of blood and a very slight shock. The temperature fell within a few days to normal; the appetite returned; the child gained rapidly in weight and strength, and the photograph which I exhibit shows that now—two months after the operation—she is in fine general health and able to be about on crutches. I have replaced her old hip-joint splint to protect the leg from any accident that might occur from too much freedom in motion.

Another case was one that I had operated on three times previously, always with recurrent abscesses, and I felt in despair of ever succeeding in removing all of the necrosed bone. I opened up an old sinus and bored completely through the acetabulum into the pelvic cavity, and drained an abscess that I am quite sure I never would have reached without this instrument. The child is now on the road to recovery, and is able to be up and about. For over a year before the operation he had been confined to his bed.

I give these as samples of the cases which I have operated upon with the instrument, and in which I have been more than pleased with the results.

Of course, there are many cases in which all sorts of instruments and devices will have to be resorted to in order to complete the operation—that is, cases in which there is extensive disease and considerable destruction of soft parts has taken place. All I am claiming for this instrument is that it provides us with a much quicker and easier method for removing the diseased and necrosed bone than any other instrument I have seen. Many of those commonly in use, as you know, require no little force and manipulation; and it follows as a matter of course that the shock to the system of the patient is correspondingly great. It is not my object to go into a discussion of the different methods of hip excision or to claim too much for the Deyon instrument, which comes in three sizes, and the one is selected which is most suitable to the age of the patient.

In my judgment the Deyon instrument has done for hip-joint disease very much what the angiotribe has done for abdominal surgery.

I may state that this particular instrument, which I now present for your inspection, was made by W. F. Ford & Co., and is an exact duplication of one imported from Europe.

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## DISCUSSION.

Dr. S. L. McCurdy said that this was certainly a very convenient method of cutting bone in deep wounds, and it was a very satisfactory instrument for operating upon structures where there is a definite field; however, it appeared to him to be too mechanical and too stiff to serve for the eradication of diseased tissues. In a recent case he had excised the upper end of the head and neck of the femur, and had found that the acetabulum had perforated through into the pelvis. In such a case this instrument might do a great deal of harm if not guided by the cautious use of the finger.

Dr. A. M. Phelps said that this instrument had been devised by Doyen for the purpose of making a new acetabulum, and it was a perfect instrument for that purpose. It had occurred to him that in children having extensive disease of the neck and head, and perhaps also involving the acetabulum, that if the great trochanter were taken off and an instrument then selected which would remove all the diseased tissues it would be found very convenient. The disease is removed equally and thoroughly. The fear of slipping through the pelvis with that instrument was fallacious, because as one advances one employs successively larger sizes of the instrument. The method was a decided improvement on the older technique, not only because of the very thorough eradication of the disease, but because the length of the operation was materially reduced.

# THE DIFFICULTIES IN MAKING A DIAGNOSIS IN THE BONE LESIONS OF NURSLINGS.

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The title of this paper suggested itself to me on account of the paucity of symptoms presented by several cases in babies in my wards during the past year which rendered an early and definite diagnosis most difficult and unsatisfactory. I present it in the hope that the discussion which it may bring forth from my fellow-members, together with observations I myself may make, will add somewhat to our means of making a more definite and an earlier diagnosis.

By nurslings I have meant to convey those babies under two years of age who are either breast-fed or bottle-fed, and in whom dentition has not begun or is only partially completed. However, the limitation need not be made, as many of the symptoms and blood changes to be spoken of occur in young children as well as infants.

On being called to see a baby with one or more of the cardinal symptoms of bone inflammation certain of the following formidable array of diseases may present themselves to the clinician for differentiation and exclusion, viz.: tuberculous osteomyelitis or epiphysitis, syphilitic periostitis and osteochondritis, achondroplasia, rhachitic proliferation, softening or eburnation, scorbutic subperiosteal hemorrhage, or, perhaps, epiphyseal separation, osteosarcoma, epithelioma (?), rheumatism, "growing pains," rheumatoid arthritis, acute anterior poliomyelitis, acute osteomyelitis, acute arthritis, and also influenza, typhoid, colon, and pneumococcus infections; osteomata, whether exostosis or hyperostosis; osteopsathyrosis, spontaneous fractures, and cysts.

The following is a case in point, involving a differential diagnosis between tuberculous osteomyelitis, specific osteochondritis, the subperiosteal hemorrhage of scurvy, and sarcoma:

Case I.—C. C., a boy, aged five months, was put under my care on January 1st of this year. The child seemed in great pain in the right leg, which was held flexed at about 45 degrees, rotated outward, and abducted the same amount. The mother stated that the child had had pain apparently for three months—*i. e.*, from the time he was two months old—and she noticed he had held his leg constantly still and moved the left leg freely, so that she thought the right leg must be paralyzed.

*Family History.* The parents were refined and well-to-do, apparently healthy people. They had been married ten years before any children were born to them, but any miscarriages were denied. The father had led a rough life on the plains, and had been more or less dissipated. He acknowledged drinking to excess, had had venereal warts, but denied syphilis. He had had no rash, sore-throat, or headache, etc., at the time of the appearance of the venereal warts, and had received no medication for a prolonged time. (Further data on this point was unobtainable.) He is subject to "rheumatic gout." The patient has a brother and sister who are said to have always been strong and well. A paternal uncle died of phthisis, and a maternal uncle had a sinus in the back. The first wife of the patient's father died of consumption eleven months after marriage. Any history of malignant tumor in the family is lacking.

*Previous History.* The labor was easy and normal, and the child at birth was large and apparently healthy. No definite history of "snuffles" or rash is obtainable; but the baby had, when one month old, a large red, ecchymotic spot on the left cheek, which shortly disappeared. When two months old a swelling appeared at the left wrist, with malposition of the hand, which the mother thinks involved the joint. This was treated by the family physician with pasteboard splints and mercurial ointment, and followed by recovery; but some thickening is still easily detected at the lower left radial epiphysis. The feeding had been combined bottle-feeding and nursing. At the time of admission the child

nursed twice daily, and was bottle-fed on equal parts of milk and water, *sterilized*, every three hours.

Pain and night-cries had been present for two months before I saw the patient, and insomnia has been a marked symptom. The maximum temperature, reached a few days before admission, was 103° F., but did not exceed 100° F. after that. As to any history of trauma, the father thought a former nurse was of such a nature that she would have unhesitatingly struck the child or wrenched an arm or a leg in anger, and attributed the child's condition to this; but he had no definite knowledge to this effect.

Condition of child on admission to the hospital, January 8th: On inspection a plump, well-nourished and well-muscled baby, and large for its age, was seen, weighing eighteen pounds two ounces. The lips, mucous membranes, cheeks, and nails were of a good color. The skin everywhere seemed normal, with no scars or discolorations suggestive of ecchymoses or subcutaneous hemorrhages. The gums were normal in appearance, and no teeth showed signs of erupting. The head was of good shape, with fontanelles open, but not protuberant. Chest and abdomen were normal in shape, and there was no beading of ribs or enlargement of epiphyses except as above stated (viz., left radius). The eye at once noticed the malposition of the right thigh and a distinct, fusiform, diffuse, spindle-shaped swelling at the upper third of the thigh, measuring $10\frac{7}{8}$ inches (28 cm.) in circumference against 10 inches (25.5 cm.) on the left. This swelling was said to have increased rapidly of late.

On palpation the lymphatic glands were not appreciably indurated anywhere except in the right inguinal region and right iliac fossa. The spleen was palpable, and extended 2 cm. below the costal margin. Percussion also disclosed this. Auscultation was negative except for a slight bronchitis involving the larger tubes.

The swelling in the right femur seemed to extend from about the middle third of the thigh to a point near the coxo-femoral articulation, but not into it. It was larger above than below, hard, did not fluctuate, and involved apparently more the anterior and external aspect than the posterior and internal. Muscular spasm was marked, and any movement seemed to cause pain and

brought on a crying spell. The other joints did not show this tenderness. One point on the external aspect seemed to be more sensitive than the rest. A radiograph was made, which showed an hour-glass shape in the bone, with straight, regular edges. The blood count gave: Reds, 4,100,000; whites, 18,400; hæmoglobin, 80. The differential count showed lymphocytes increased; no myelocytes or eosinophiles. Beginning poikilocytosis was noted. The diagnosis, so far as the blood was concerned, showed a slight secondary anæmia.

With this data before me I at first thought of two possibilities —scurvy and tuberculous osteomyelitis. For the former I gave modified Pasteurized milk, lemon-juice, and beef-juice; and for the latter employed traction in the line of the deformity of $1\frac{3}{4}$ to $2\frac{1}{2}$ pounds, which seemed to afford almost immediate relief. On the third or fourth day after the traction was instituted the baby seemed perfectly comfortable, slept all night, appetite became vigorous, and increased weight was shown. I reluctantly gave the child for three successive nights tuberculin from Trudeau's laboratory, the most reliable I could get, with absolutely negative results. I say "reluctantly," because I felt if the reault had been positive a bronchial lymph node might be responsible, and not the thigh trouble; and, beside, the usual site for tuberculous invasion—the epiphysis—did not seem the location of the trouble. If negative, we all know tuberculin is not infallible, and a wrong inference might be obtained. The picture was not that of a true tuberculous coxalgia, and the child's age and the rapidly increasing induration was against such a diagnosis. The blood findings, according to Dane's forty-one published observations,[1] led me to think the high leucocyte count would indicate tuberculous abscess formation; but Brown,[2] after an examination of seventy-two cases, dissents from this conclusion unless there is a secondary infection; "simply increased activity of the tubercular process itself," he claims, "would not give an increased leucocyte count over 2000 to 3000 above normal." Thus my diagnosis of tuberculous osteomyelitis was most unsatisfactory and by no means conclusive.

[1] Boston Medical and Surgical Journal, May 28, 1896.
[2] Transactions of the California Medical Society, 1897.

My diagnosis of scorbutus also lacked many usual symptoms to sustain it. The gums were normal, no subcutaneous hemorrhages had appeared, and there was no anæmia to speak of. The child was well-nourished, and the other limbs showed no tenderness. The only possible straws for the scurvy theory to hold to were the possible subperiosteal hemorrhages and the fact that many of the best authorities, such as Starr, Rotch, Lewis Smith, H. L. Taylor, and others, observe that scurvy shows no bleeding gums prior to dentition. Aspiration brought out only a few drops of blood, which was normal in appearance and not black or disintegrated. Thus following the old whist rule, "when in doubt lead trumps," I ordered mercurial inunctions. After one week of this treatment the leucocytes had fallen to 16,800, but after two weeks the swelling had increased one-half an inch (1.5 cm.), and was appreciably harder, and my diagnosis of congenital syphilis was shaken; however, as the child seemed so much improved in every other way, I persisted in the inunctions. I then called in an eminent consultant, who suggested sarcoma, and advised an exploratory incision, with hip-joint amputation, of course if sarcoma were found; but he felt possibly metastases had already taken place; but if not, and sarcoma should be found, permission should be obtained, in advance of any puncture, to go ahead with the amputation, for fear of metastases from the puncture. The child looked so rosy, bright, and merry that I determined to trust to "the trump" a little longer, with the result that the patient was discharged from the hospital on February 21st, with no induration in the right thigh and a freely movable joint. His general condition was excellent. To my mind it was a clear case of syphilitic osteochondritis.

Carl Beck's paper on "Cartilaginous Cysts Near the Epiphysis of Long Bones in Children"[1] had not then appeared, else I should doubtless have added this disease to my difficulties; but he tells us the skiagraph differentiates this condition from osteosarcoma, in that the former gives a translucent appearance at its situation, with straight, sharply marked edges of bone, while sarcoma gives no such translucency and an irregular, external demar-

[1] American Journal of the Medical Sciences, June, 1901.

cation. Wiegel has called my attention to the mottled or spongy look in his excellent skiagraphs of sarcoma in bone.

Ridlon, in vol. iv. of the TRANSACTIONS OF THE AMERICAN ORTHOPEDIC ASSOCIATION, speaks of a number of syphilitic bone and joint lesions seen by him, and in support of his diagnosis, which had been questioned by eminent authorities and pronounced tuberculous, although his results with antisyphilitic medication were quite suggestive, quotes from Bumstead and Taylor's *Venereal Diseases*, fourth revised edition, p. 735.

To what extent blood examinations will help us remains to be seen, and with the vast material at our command it would seem to me well to make blood examinations a part of our ward records in bone diseases, just as urine has been heretofore. This seems especially so, in our special work, when one thinks of the important part played by the bone-marrow in the genesis of blood. Such records should bring forth fruit in due season and increase our means of differential diagnosis. In attempting any inferences from the blood-finding in infants we must bear in mind that a normal leucocytosis exists, according to Schiff, Gundobin, Bayer, Hayem, and others, for we may have at birth from 17,000 to 21,000 white cells, and after the first feeding a digestion leucocytosis as high as 36,000. On the tenth day 10,000 to 14,000, and at the sixth month 12,000. After a meal 30,000 leucocytes is never a very high count in infants under two years. Cold baths increase the leucocyte count. It is also to be observed that a backward child's blood is more of the infantile than of the adolescent type.

Cabot gives us an excellent foundation on which to build in *Clinical Examination of the Blood* (third revised edition, 1898), and I have referred to it for certain points on the blood in infancy and childhood:

"1. All signs by which sickness is shown in the blood of adults are exaggerated in children.

"2. All forms of infantile anæmia are apt to be associated with enlarged spleen.

"3. In infantile blood the small mononuclear elements are more numerous than in the adult ('lymphocytosis of infancy').

"4. The red cells show variations in shape and size, and nucleated reds may be found.

"5. The hæmoglobin is relatively high at birth and relatively low during childhood."

It is therefore important to make our observations before meals or a cold bath, to state the child's age, and, if possible, obtain a blood record before the sickness began, to determine how much is physiological and how much pathological.

To apply this practically for diagnostic purposes in tubercular osteitis or periostitis without abscess formation (according to Dana's observations), and without secondary infection (according to Brown's), we have no leucocytosis, while in syphilitic bone disease we have the leucocytosis of a secondary anæmia. The same is true in scurvy and rickets. Acute osteomyelitis can be diagnosticated from so-called "rheumatic pains," "growing pains," and neuralgia by the leucocytosis present.

The average leucocyte count for osteosarcoma in adults (?) is high—about 17,000. Injections of tuberculin produce leucocytosis; therefore blood counts should not be made immediately after such injections. Acute rheumatism gives about 16,000, subacute 9000, and chronic 7000 leucocytes, on an average.

Hereditary syphilis is perhaps the best-known cause of a relative lymphocytosis in children, but scurvy may produce the same result.

In infancy the percentage of eosinophiles is very often higher than in adults, so that in them eosinophilia may be considered physiological; but it is also very characteristic of malignant bone disease and osteomalacia, as found by Neusser and his pupils. Cabot, from whom I have obtained most of the foregoing, mentions having seen eosinophilia in osteomyelitis also. In some cases of syphilis and syphilitic disease of the spinal cord we find eosinophilia.

Myelocytes are found especially in malignant bone disease, hereditary syphilis, and acquired syphilis and other conditions where there is a grave anæmia with leucocytosis.

Normoblasts show more a severe secondary anæmia, and megaloblasts show a *very* severe secondary anæmia in bone disease as elsewhere. Applying this data to the case cited, we find the infant had 18,400 leucocytes and relatively increased lymphocytes, which would suggest exclusion of tuberculous bone disease in favor

of syphilis or scurvy. Absence of nucleated reds, myelocytes, and eosinophilia, together with no marked diminution in the red count, would tend to exclude sarcoma from the preponderance of authority, especially as this was not what might be called a small tumor.

Thus, if this reasoning is logical, we would narrow down to syphilis and scurvy, and as the supposed subperiosteal hemorrhage was the only likely symptom of scurvy, hereditary syphilis alone remained.

Certainly, it seems to me, the blood examination was of value as an additional aid in the diagnosis of this case.

I will cite briefly another perplexing case.

Case II.—H. R., aged eighteen months, son of a laborer, was admitted to the Hospital for Crippled Children, April, 1901, with a marked swelling extending from the upper border of the right hypochondriac region to the lower border of the right iliac region, and from the mid-axillary line around the right side of the loin nearly to the spinal column. The duration of this abscess was said to be four weeks; that is, the parents had noticed it for that length of time. In the lumbar region fluctuation was detected, and the pus seemed near the surface. The child was anæmic, emaciated, tubercular looking, and evidently in pain. Large furuncles were present on the occiput and right eyelid. The temperature was 101° F. The spine was rigid, and double psoas-contraction of some 90 degrees was present, but no kyphosis or other deformity was apparent. Family history was good. The patient had been healthy up to September, 1900, when he had measles and whooping-cough, and had a traumatic history of having fallen down five or six steps and off a chair previous to the onset of the present trouble, a month ago. His father stated that in the morning the child was apparently well, playing and talking, and in the evening could not use the right leg. Pain had been constant since, with fretful nights, anorexia, thirst, fever, sweats, constipation, but no vomiting. Palpation in right iliac fossa gave no induration in the region of the appendix.

The symptoms and picture were those of Pott's disease, with double psoas-contraction and lumbar abscess, but no kyphosis. The blood count briefly showed 40,000 leucocytes, a low red

count, and low hæmoglobin, increased polymorphonuclear neutrophiles and small mononuclear leucocytes. Quite a number of cells resembling myelocytes and a few normoblasts were also found. This was against tubercular abscess in the extremely high leucocyte count and the presence of marrow cells found, as an incision demonstrated, evacuating 500 c.c. of thick, greenish pus, sometimes mixed with blood, from which cultures showed the presence of the staphylococcus pyogenes aureus. The abscess cavity was curetted and drained, and the child showed rapid improvement. The psoas-contraction gradually yielded to traction in the line of the deformity.

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## DISCUSSION.

Dr. L. A. Weigel said that the first case reported recalled a difficulty experienced by him last year in attempting to make a diagnosis in an infant one year and a half old. The child was well nourished and apparently perfectly well, but the mother noticed pain on movement of the right hip. Examination showed the movements of this joint to be practically normal, but just above the trochanter was a marked swelling suggesting abscess. A radiograph showed a small mass in the centre of this swelling, and it was decided to operate. On opening up this tumor a small quantity of material looking like tubercular matter was removed, and the tumor itself was dissected out entirely. Even then the diagnosis was in question, and a very careful microscopical examination alone settled it. The growth proved to be a typical spindle-cell sarcoma. The child did well after the operation for a few days, but then general symptoms supervened, and after six or seven weeks the child died. A post-mortem examination was made, and it was astonishing to see how thoroughly diffused was this malignant process. Every abdominal and thoracic organ was involved; there was a large mass in the inner side of the pelvis through which the ureter ran; the lungs, heart, and every other internal organ were affected with the malignant process. The points of interest were the slight symptoms in the beginning and the rapidly fatal termination from a general sarcomatous infection.

Dr. R. W. Lovett, of Boston, said he had followed up a good many cases of tuberculosis to determine the blood-count. He had been unable to find any relation between leucocytosis and the existence of tubercular abscess. He had asked Dr. Richard Cabot if the statement were justifiable that the leucocytosis in tuberculous abscess is of no account, and Dr. Cabot had replied that this seemed to him a perfectly fair statement. As a rule, there was not a high leucocytosis, though it often ran up to 15,000 or 20,000. With regard to the diagnosis of joint disease in young children there was one condition which had always bothered him, namely, the nutritive disturbances occurring around the epiphyses. It was often difficult to differentiate it from an acute osteomyelitis or an acute destructive joint disease. This condition he saw from time to time in the hips of young children, and he found it almost impossible to differentiate it from syphilitic osteochondritis. It was localized chiefly in one joint. Pathological evidence of this condition was not at hand, but the clinical appearance pointed to an epiphyseal hyperæmia such as is seen in all the joints in scurvy.

Dr. Phelps said he presumed the diagnosis was correct. A recent paper of Dr. Park stated that many cases of malignant disease in the adult had disappeared in just such a remarkable way. Frequently degenerative changes took place in sarcomata and epitheliomata, and these cases would subside very rapidly and completely.

Dr. McCurdy said he desired to place on record some facts which seemed to emphasize the position taken by him several years ago with reference to syphilis as the cause of many of these conditions. He had now under his care a young woman who had been treated in Boston by one of the Boston orthopedic surgeons for tubercular disease of the ankle. She had been placed upon a splint, with a high sole on the other foot. She had worn this for six months, and had then had plaster on the foot for a time, when she had been pronounced cured. She had come to him about two months ago with what appeared to be a return of the same condition. He had placed her on iodide of potassium and had used local irritants, and she was already entirely well. This patient's

sister had come to him recently with a "scrofulous" ulcer on her cheek. He could report a great many other similar cases.

Dr. W. R. Townsend, of New York, thought it was just as reasonable to conclude that the pathologist found tissue which resembled sarcoma, but was not true sarcoma, as to conclude that sarcoma had been present and had disappeared. All pathologists know that they meet with tissues very closely resembling sarcoma, and yet not really sarcoma, and that the microscopic diagnosis is not infallible. The speaker said that at the Hospital for Ruptured and Crippled they met with many syphilitic lesions of bone, and he thought that under two years of age it should be remembered that tuberculous lesions are comparatively rare and syphilitic diseases of the bone are comparatively common. Certainly syphilis was much more common than many writers would lead us to believe, and they would recover under rest and the internal use of iodide of potassium.

Dr. Ridlon said he wished to remind the Association once more that all multiple joint diseases should be suspected of being syphilitic. He had spoken of this several times, and within two or three months he had had under his care a little boy with disease of the cervical spine, the right elbow, both knees, and the ankle. The multiplicity of the lesions would suggest syphilis. The parents are both intelligent and healthy, and there is no ground for the suspicion of syphilis in either parent, but the diagnosis of syphilis nevertheless seemed to him perfectly plain. These joints had been immobilized and the child given mercurial inunctions and iodide of potassium internally. The improvement had been as marked during this comparatively short time as one would expect to get in two years if the joints were tuberculous. In the children of most colored people and of New York coachmen one should suspect syphilis.

Dr. R. Tunstall Taylor, in closing, said, with regard to leucocytosis in bone disease, that unless our bacteriological methods were defective, in a certain number of pus cases opened at the Hospital for Crippled Children there had been found in the tubercular

pus certain pyogenic bacteria. If these were present in certain tubercular abscesses, having become secondarily infected before the skin was broken, one should find a leucocytosis habitually. This mixed infection probably comes from the skin, and it would, therefore, lead us to think it unwise to wait for the so-called "parchment covering" before opening. In regard to exploratory operations for sarcoma, an eminent surgeon had led him to understand that in making an exploratory incision one should go ahead with the amputation if the tissue appeared to be sarcomatous, for otherwise one would almost certainly get metastases—*i. e.*, if the exploratory wound were closed and radical operation postponed until a pathological report could be made from a specimen. With regard to the multiplicity of lesions in syphilitic cases, he would say that in the case presented by him there had been only one lesion, unless the slight thickening at the radius could be called a thickening.

# THE TREATMENT OF ABSCESSES IN TUBERCULAR BONE LESIONS.

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It is now ten years since the Association has discussed the treatment of the so-called abscesses in connection with tuberculous lesions of bone. A careful perusal of the discussion which took place at that time does not leave any clear conception of the plan of treatment most likely to prove efficient, as numerous methods are advocated by different men. It is with a view of getting a more recent, and if possible a unanimous, expression of the Association, for the benefit not only of the members of the Association but also for the students who look upon the Transactions as an authority, that this paper is presented.

It is within comparatively recent years that the nature of the cold or chronic abscess has been accurately known. The condition might possibly more properly be called a tuberculous cyst than an abscess, as there are none of the cardinal points of inflammation present except the swelling.

In the commencement a tuberculous nodule forms in the soft parts adjacent to the bone lesion from an extension of the tuberculous process. After infection these soft parts go through the same process of caseation and liquefaction that takes place in the bone. Thus a cavity is formed, with liquid contents and a distinct wall, which has been long recognized as the pyogenic membrane. The wall is the most important part, as in it, in the outer part, are contained bacilli and the resulting gray tuberculous nodules. The inner portion of the wall is in process of disintegration, and, like the contents of the cavity, is comparatively inert, containing few if any bacilli. The growth of the abscess is

in the line of least resistance, and this being in the connective tissue structures, vessels, and nerves or any fibrous structures are rarely attacked. The abscess will burrow by the weight of its contents downward, infecting the soft tissues as it goes, and thus carries the tuberculous disease into distant parts, rendering the treatment of the diseased soft tissues harder than that of the original focus. In order successfully to get rid of the infection it is seen to be necessary to clear out the wall of the abscess which contains the possibility of reinfection, as well as to evacuate the liquid contents. The various plans of treatment as outlined in the discussion of the Society and seen in most text-books may be classified under the following heads :

1. To leave abscesses alone—the so-called expectant treatment.
2. Aspiration.
3. Aspiration, with injection of antiseptics.
4. Incision, with drainage.
5. Excision.

When the diseased bone from which an abscess originates is properly protected and put at rest, absorption of the fluid contents does sometimes take place, leaving a caseous mass with a fibrous capsule, which may ultimately become entirely fibrous or calcareous, and result in cure. One undoubtedly finds cases in which it is the part of wisdom not to interfere in a radical way. Such might be a deep-seated abscess of the spine that is giving no symptoms, and others which, with proper supporting treatment, are diminishing in size. One may delay operative treatment, also, to get a more favorable point of exit, it being perfectly right to allow a psoas abscess to work down the thigh so as to open it away from the groin, and thus run less risk of infection. Under no circumstances should an abscess be left when the skin is becoming reddened from tuberculous infiltration, as it will refuse to heal if incised, and will ultimately break down unless completely excised. Aspiration can serve no good purpose in the treatment of abscesses, as only the fluid contents which are comparatively inert can be withdrawn, and that only with a good deal of patience and dexterity, to prevent plugging of the needle with caseous material. The wall is still left to continue the formation of the pus and the infiltration of further soft tissues, and there is grave

danger of the track of the needle becoming infected with tubercle and a sinus result.

*Injection with antiseptics* after aspiration is open to the same objection, as one cannot hope to inject a sufficiently strong antiseptic to destroy the wall without getting serious constitutional disturbances.

The common reply one gets from a student to the question as to treatment is to "incise and drain." This, to my mind, is a most dangerous doctrine, and yet it is the most prominent in nearly all text-books, even on orthopedic surgery. We all remember the long months and sometimes years of treatment of discharging sinuses, due in large measure, the writer thinks, to drainage-tubes. If it were possible to open an abscess in a good location to drain well, under strict aseptic precautions, and have it drained and dressed carefully for a considerable time, one might possibly expect a cure; but it may be safely said that scarcely a single case of tuberculous abscess opened and drained with tubes escapes infection with true pyogenic organisms—the streptococci or staphylococci. A child thus infected is infinitely worse than before, and in cases of psoas abscess runs extreme risk of septicæmia and death. So I think I am safe in making a positive statement—at least, so I infer from my experience—that it is never wise to incise and drain an abscess except in urgent cases, such as when, in spinal abscess, dyspnœa is present from pressure on the vagus or bronchi, or other pressure symptoms require immediate relief.

The method advocated by Mr. Watson Cheyne, of complete excision of an abscess wall and contents entire, is theoretically all that could be desired, but practically its application is limited to certain locations. It can only rarely be used in spinal abscesses, but may be most useful in some abscesses of the thigh.

The most practical and the most successful method in the hands of the writer has been that of free incision—multiple, if necessary—with careful scraping of the wall of the abscess with a spoon and complete closure of the wound or wounds.

The incision should be as free as possible, the wall being scraped carefully and systematically around all sides, as one would scrape a uterus for disease of the endometrium. If any vessels are near

that might be injured, that portion of the wall may be efficiently curetted with a swab of iodoform gauze on an artery clamp.

One might expect a general infection following such an operation; but if the incision is free, so as to allow the escape of all débris, and a flushing spoon used, such as devised by Barker, with sterilized water or weak sublimate solution, no infection is likely to take place.

After as thorough a scraping of the wall as is possible the whole cavity may be swabbed out with pure carbolic acid, followed by alcohol, to destroy any remaining bacilli or tubercles. The incision may be then completely closed and a firm dressing applied. In nearly all cases there is primary union, the walls becoming glued together, thus obliterating the cavity.

A. H. Tubby, in a recent number of the *British Medical Journal*, in advocacy of the open method of treatment of spinal abscesses, recommends the flushing of the cavity with sterilized water, followed by a solution of menthol, as used by Robert Jones, the formula being: menthol, one drachm; rectified spirits, one ounce; glycerin, eight ounces. This should, according to Tubby, be rubbed into the edges of the incision, to prevent infection of the skin and subcutaneous tissue. The method has proved most successful in my hands and in the hands of some of my colleagues in the Hospital for Sick Children. All of my cases—some twenty-five in number—during the past year have been treated in this way with very satisfactory results. If the bone lesion from which the abscess originated is still active, and the tissue still being broken down, of course, the abscess will recur; but the same operation may be repeated several times if necessary, and, in my experience, will ultimately succeed. Thus you never have at any time foul discharges about the patient; you have no continued dressing, and small risk of septic infection and amyloid disease.

In the course of treatment of the wall of the abscess wherever possible the bony focus should be sought for, scraped, and any sequestra removed. It does not necessarily follow that because all the tuberculous wall is not removed that the operation will be a failure. We know the recuperative power of nature, and if we remove the bulk of the diseased tissue the phagocytic power of

the leucocytes will clear up the balance. This should not deter one, however, from removing as much tuberculous material as possible.

This plan of treatment is applicable in a general way to abscesses in any location, but a word or two may be said about the treatment of special cases.

In the cervical region abscesses should not be opened by way of the pharynx, unless urgent dyspnœa is present, on account of the possibility of mixed infection. All lateral cervical abscesses should be opened in the posterior triangle, immediately behind the sternomastoid. In the dorsal region, above the eleventh vertebra, abscesses may be located in front of the spine, displacing the aorta and œsophagus or making pressure on the vagus or bronchi. These may rupture into the lungs or pleura, or may work out between the ribs, or may pass down through the diaphragm. Those in front of the spine may be treated by the expectant plan if symptoms are not urgent, but if interference is necessary a portion of the rib and transverse process must be excised and the abscess evacuated in this way. Abscesses in the last dorsal or lumbar vertebræ will follow the sheath of the psoas muscle and rupture the sheath just above or below Poupart's ligament, filling the iliac fossa and burrowing down into the thigh or up above the crest of the ilium into the lumbar region.

The treatment should be by free incision—multiple, if necessary—as far away from the groin as possible, with scraping of the wall, care being taken to avoid the posterior wall where the iliac vessels are situated, afterward swabbing with iodoform gauze. It may be necessary to make an opening in the lumbar region as well, to entirely evacuate the cavity. A strand of gauze can be carried between the two openings and the cavity thoroughly cleansed in this way, afterward closing both wounds.

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## DISCUSSION.

Dr. R. W. Lovett said, with regard to mixed infection in these tubercular abscesses, that in the last two years he had given special attention to this subject, and had not seen mixed infection, so far as he could recall without his notes, although there had been a few

contaminations from staphylococcus albus. He would ask what method had been used to establish the fact that the pus was tubercular. Some years ago he had sewed up a good many hip abscesses, but the majority of them had broken down afterward, and had then been rather worse than before. This method had been largely abandoned in Boston. If the abscesses were left open there could be no question that they all became infected. He had been trying some experiments with cold abscesses last winter. Cultures were taken from the pus and from the dressings. The latter were proved to be sterile. The first dressing was delayed four or five days, and was then done with the house officer and under all the necessary precautions as for a laparotomy. In every one of the cases followed it was found that in spite of the great precautions taken from the eighth to the fourteenth day, infection took place in those cases in which the attempt had been made to keep them open. With regard to psoas abscesses, Dr. Lovett said he had reported a series of cases occurring from 1890 to 1900, in the *Boston Medical and Surgical Journal* for May 16, 1901. The cases occurring in the first five years of the period gave a mortality per cent. of 50, while those occurring since 1895 have a mortality of 25 per cent. In all the cases the policy pursued had been incision, with the exception of four. It could be assumed that all of the cases were infected because he did not believe that any discharging sinus could be kept clean for any length of time. He did not think, nevertheless, that Dr. Starr was justified in taking such a gloomy view with regard to psoas abscess. He was of the opinion that about 50 per cent. of them would get well, when the end results were considered and a much higher percentage of intermediate cases was taken. He was personally becoming very skeptical with regard to the advisability of stirring up the pyogenic membrane of tubercular abscesses. The psoas abscesses in his practice, seen during the last two years, had been opened by one incision, one inch and a half long, in the groin. Some of the abscesses had been washed out and some had not. A tube had been introduced, and on the second or third day the patient had been gotten up into the upright position. This had been done because where two incisions, lumbar and iliac, had been used the mortality had been much higher than in those cases operated upon

by either the lumbar or the iliac incision. This had been the operation he had employed up to two years ago. He now opened them in the iliac region, with the hope of securing drainage, and got the patient out of bed. They had closed much more quickly and had yielded much better results than formerly. It was interesting to find that Dollinger, of Budapest, in an analysis of some fifty cases, had come to the very same conclusion. He does not irrigate, and removes the tube on the third day. Dr. Lovett said that his own experience with the early removal of the tube had been unsatisfactory, and he leaves it in at least two weeks, knowing that the abscess will become infected, but also knowing that about 50 per cent. of the cases will recover.

Dr. Phelps said that in New York the plan was to make an incision only in the front, and he saw no advantage in making an incision in the back, as this only increased the chances of infection. All psoas abscesses should be opened, infection or no infection. There was nearly always a good deal of débris, which should be removed. These abscesses should be washed out, as Callender had recommended, under high pressure, and then a drainage-tube introduced up to the point of disease, so as to secure the exit of débris and pus. Very soon the abscess would contract down upon the tube. He had followed this plan for fifteen years in psoas abscesses, but was not yet prepared to state what was the mortality. In his opinion, aspiration was worse than useless, and it was astonishing that some of his distinguished colleagues were still advocating the use of the aspirator for these abscesses. He had at one time invented an aspirator for this purpose, but he had long ago discarded it. The method had been revived by Dr. Gibney, of New York, but he, too, had abandoned it. The method simply lulled one to sleep, but gave no accurate knowledge of what was going on in the abscess. It was imperatively necessary to open the abscess and introduce the finger for the purpose of exploration. In 90 per cent. of the cases the abscesses would open anyhow and would become infected; hence, one should anticipate this process and, by exploration, put one's self in the position to intelligently treat them. It was a mistake to wash out these abscesses with sterilized water. The disease should be gotten out as far as possible, and the cavity

washed out with pure carbolic acid, followed by alcohol. Gauze should never be used, because it acts as a plug. Either introduce a large rubber tube or a large glass tube, and pack through the tube. This would give effective drainage. The tissues would very soon contract upon the tube, and a sinus would be left the size of the tube. It took thirty or forty days for bone to fill up. The soft parts should be held apart with solid material, which would prevent them from uniting. There would be no infection and no absorption with pure carbolic acid. It unites with the albuminous materials, forming an albuminoid, and this is absorbed by the lymphatics and destroys the bacteria beyond the focus of disease. It was a good rule never to scrape a sinus or an abscess with dead bone at the bottom. If an extensive curetting were done in a psoas abscess, and the focus of disease still remained, there would be infection of the entire surface. He was glad to see that all were coming around to the idea that these abscesses should be opened. The smaller the abscess the less the mutilation of the soft parts, and by opening the abscess one prevents the involvement of other tissues. This often saves many joints from excision.

Dr. H. A. Wilson said that in discussing this question of treatment the main difficulty was that one was apt to look upon a tubercular abscess as an isolated pocket, very much as the ophthalmologist looks upon the eye. Some of these abscesses entirely disappear without evacuation, and he believes the cases reported to have been successfully treated by aspiration were those presenting very exceptionally favorable conditions. The main factor in the successful treatment of tubercular abscess was the reparative process in the individual. The cases treated by Treves and stated by him as amenable to treatment by the posterior incision were those in which the constitutional condition was of the very best and the reparative processes exceedingly active, and these factors must be reckoned with in all discussions regarding the treatment. In his own experience, where abscesses had been incised and let alone, and the patients had been kept in bed for a long time, they had become emaciated and the abscesses had done badly; whereas, in cases which had had apparatus applied, and the patient had been

allowed out-doors, the sinuses had been avoided. Treves' statement regarding the avoidance of foreign material had seemed to him a decided step in advance. He had opened a joint three years after injection of iodoform, and had found the iodoform unchanged. The reason it did not do any harm was that the strong reparative process in the individual had encysted the foreign body. Our primary object should be to develop the constitutional condition of the patient and improve the reparative process. Under these circumstances operation would often be unnecessary.

Dr. A. J. Steele, of St. Louis, said that his treatment of these tubercular abscesses was peculiar in only one particular. After thoroughly emptying he used water as hot as the hand could bear for washing out the cavity. This was injected repeatedly with a hard-rubber syringe; after thorough cleansing the cavity was filled with iodoform mixture and the opening sewed up. The method had given him remarkably good results. So long as there was active disease there would be a discharge, but in all other cases he expected a prompt cure.

Dr. Frank E. Peckham, of Providence, said he was particularly interested in the method described in this paper. He had employed the same method in hip abscesses, and about two years ago had reported about fifteen cases treated by this plan. Dr. Steele had touched the keynote in the treatment when he said that everything depended upon whether or not pus formation had ceased. If it had, these abscesses could be cleaned out and closed up permanently; if, however, there was still an active process, pus would form, and the abscess would refill. In his own work it had been necessary to be extremely careful about details. The abscess cavity must be very carefully closed by the application of a very tight compression bandage. Not only this, but it must be kept tightly applied, and if this were left to the house officer the result would probably not be satisfactory. He had often given bromide the first night rather than loosen this compression bandage. If one failed to obliterate the cavity, all that was left was the discharging sinus, which would have existed in any case; hence, there was nothing to lose and a great deal to gain. He had never

seen any emaciation or any difficulty from keeping the patient in bed for a month. When he had begun work in this field he had kept the patient in bed several weeks to determine whether or not the abscess was increasing in size. If it were, he waited until this had become stationary. While adopting this waiting policy he had only found one abscess which had disappeared spontaneously.

Dr. Ridlon said it seemed to him a shame that such a bugaboo as tubercular abscess should create such a disturbance in this Association. Tubercular abscess was a mere incident in connection with tubercular joint disease, and was a matter of not the slightest importance. He had been taught by old Alonzo Clark not to treat patients too much, but to let them get well if they could, and this motto was good to remember in connection with the management of tubercular abscesses. He had tried hot water, pure carbolic acid, etc., and had found them all of no use. As to passing a tube up in a psoas abscess to the seat of disease, it seemed to him that Dr. Phelps must have a most intelligent tube which would catch every germ and eliminate it. When a tubercular abscess was opened, or opened spontaneously, the main body of the abscess closed up and a track remained which acted as a sewer, and which did not need the intelligent tube to catch bugs at the upper end. If one meant by infection that by careful bacteriological investigation other micro-organisms than tubercle bacilli could be found, no doubt this infection could be discovered in any case. But what of it? If the patient grew fat, and had no fever, and was getting better every day, what matter was it if these organisms were there? Some of these cases when operated upon do present bad symptoms, but none of the cases not subjected to operation present such symptoms; hence, why disturb them when they are well, and make them sick? If by infection one meant the development of symptoms of septic infection, then he would say the best method of avoiding this was by refraining from disturbing these abscesses.

If any tuberculous material could be left in an operative case, and would be absorbed, as Dr. Starr said, and he thought this was true, then why not leave it all? It could all be left there, and recovery take place just as well. If a deep, unreachable, dangerous spinal abscess could be left without being operated upon, and the

patient escape with his life, why not leave other abscesses, whether deep or superficial? He was sure this could be done, and that the patient would escape with his life in almost every case. Dr. Starr would have us believe that tubercular abscesses allowed to break do not close, yet every one present must know that they all do close if they are left alone. Why, then, be worried about these abscesses? What matter if they are open a month or two, or a year or two, if the patient is strong and fat, and is improving? For one, he would not care to take the risk of operating upon these cases. He had tried the carbolic acid and the iodoform and the hot water, and had no desire to use them more because he was satisfied to allow his patients to get well without such interference. Anyone who had not followed a considerable number of cases of tubercular abscess under the let-alone policy must necessarily have a one-sided view of this subject. He did not dispute the fact that many of the cases operated upon recover; but how many of those present had let these abscesses alone and had noted the result? He had done this; it had been his routine treatment for twenty years, and his patients had recovered.

Dr. Jos. E. Root, of Hartford, said the remarks of Dr. Ridlon coincided exactly with his own views. We were too apt, as orthopedic surgeons, to dwell entirely upon the prominent lesion. These tubercular abscesses are produced by tuberculosis; hence, we should get at the cause of the difficulty by turning the patients out "to grass," so to speak, and improving the general health. He had seen many cases with tubercular abscesses recovering spontaneously. Many cases of tubercular joint disease were taken away from hospitals by their disgusted parents, and were allowed to roam at large in the open air, and they subsequently recovered. He believed that if a small quantity of pus could be absorbed, a larger quantity could be.

Dr. G. G. Davis said he agreed with Dr. Ridlon, for, personally, he believed it was wrong to apply the rules of general surgery to orthopedics. The rule to evacuate pus wherever found did not seem to him applicable to abscesses connected with bone and joint disease. He thought Dr. Phelps' method was perfectly applicable

if one expected to eradicate the bone lesion, but not otherwise. In spinal disease it did not seem to him advisable to directly treat them by operative means, hence he would not interfere with psoas abscesses. Certain psoas abscesses which progress downward below Poupart's ligament, and which cause constitutional symptoms, may be opened with advantage. In a recent case a psoas abscess had opened posterior to the great trochanter, and had caused high temperature and intense pain. Such an abscess should be opened, but not those giving rise to no symptoms. The cases of death in connection with tubercular bone disease had, as a rule, been those in which there had been long-standing discharging sinuses. As a rule, after the abscess had once been opened the abscess required a good deal of attention, whereas a child could go around for months with a small or medium-sized abscess and not require any special attention. He believed in only operating in those cases in which it is done for absolutely curative purposes, and even here he was a little doubtful about its advisability. It was extremely hard to find the exact point from which the pus proceeds, hence the surgeon was apt to find it necessary to do a very extensive operation.

Dr. Weigel said that he had treated tubercular abscesses both by the let-alone policy and by operative means. He would take exception to Dr. Ridlon's statement that all abscesses get well with treatment or without treatment. He now had under observation a gentleman, aged sixty years, who had had hip disease in early childhood. At the present time there were six or eight discharging sinuses, which he had had for fifty-five years. He was a literary man, and could do his work every day, but a cure could not be effected. A radiograph showed complete destruction of the head of the femur on one side and of a considerable portion of the pelvis.

Dr. Ryerson, of Chicago, asked if anyone had ever seen amyloid disease in cases of tuberculosis without any discharging sinuses. Amyloid disease, in his opinion, resulted from secondary infection. He would like to know whether it ever occurs without secondary infection.

Dr. R. T. Taylor said that the tubercle bacillus was not found in the pus in his cases, but the symptoms were so characteristic of tubercular trouble that the diagnosis had been made by inference.

Dr. Phelps said that appendicitis kills, when not treated surgically, in 45 per cent. of all cases; when it is treated surgically during the interval, or before large abscesses have formed, the mortality was 3 per cent. Now, because 60 per cent. of those cases would recover, he would like to ask Dr. Ridlon if he would be in favor of treating all cases on the expectant plan.

Dr. Ridlon replied that when a disease treated surgically did kill only 3 per cent., and when the disease not treated surgically did really kill 45 per cent., he would favor treating it as Dr. Phelps does; but as this was not the condition met with in tubercular abscesses he was not in favor of such treatment for them.

Dr. C. L. Starr said that in cases of amyloid disease coming under his care there had always been mixed infection and a discharging sinus. This fact in itself was one point in favor of his method of treatment. Dr. Davis took exception to the general surgical rule about the evacuation of pus, but we must distinguish between true pus and the material found in tubercular abscess. The latter was not true pus, but a tuberculous cyst, and did not contain true pus; hence the exception to the general surgical rule. It had been said that we were simply treating the effect and not the cause. The statement made in his paper was that, wherever possible, the treatment should not be limited to the wall of the abscess, but should go back to the bone lesion. It was not always possible, of course. Dr. Ridlon's statement seemed to him exceedingly extravagant. His experience had not been that tubercular abscesses were of no importance, for he had seen them break down, a parchment-like tissue form over the surface, and a discharging sinus form. To his patients it made a good deal of difference whether the discharging sinus continued for two months or two years; they objected to it. He maintained that by proper treatment of these abscesses this foul discharge could be prevented. He treated these cases by two plans, viz.: (1) The expectant plan,

and (2) by a thorough incision and curetting. He had made the statement that in some cases it was not wise to operate, particularly in those cases which show decrease in size or absence of symptoms after observation for a time. Where the abscess was increasing in size and threatened to break down it seemed to him criminal to allow them to go on and do so. Dr. Ridlon said that these cases might escape with their lives, and while this might be true, he did not like to let his patients go on and be exposed to such great risk, even though they might escape with their lives. He maintained that the pus formation came in large measure from the wall, and not from the focus of disease. Dr. Steele's plan of flushing with hot water had been recommended by some English surgeons, and he had himself employed it with good results. He certainly made every effort to treat the constitution of the patient, both as to mechanical, protective, and out-door treatment. As to passing a tube up to the seat of the disease, it should be remembered that in a psoas abscess there may be a dozen different pockets, and it was practically impossible to pass a tube up to these different portions, and he doubted if there would be any particular advantage in doing so. He was very much pleased to hear Dr. Lovett's statement in regard to the subsequent breaking down of the abscesses that had been closed. His own plan had been to repeat the operation in cases threatening to break down. In some instances he had repeated the operation five or six times. Certainly no tubercular abscess could escape mixed infection if opened and drained, and when this occurred there would be a septic temperature, together with night-sweats and other symptoms. Dr. Lovett said that his statistics showed a mortality of 50 per cent., and he seemed satisfied with this. This was probably the average mortality in psoas abscesses. His own experience had not been large enough to warrant making statistics, but he thought we should aim at a lower mortality. If a tube must be put in, the earlier it is removed the better.

Dr. McCurdy remarked that much of the discussion had been entirely out of order, because it did not conform to the text. We should keep in mind the special variety of infection really under observation.

# ABSCESS IN THE POSTERIOR MEDIASTINUM IN CONNECTION WITH POTT'S DISEASE:

## THE REPORT OF A SUCCESSFUL OPERATION FOR THE DRAINAGE OF SUCH AN ABSCESS.

By JOEL E. GOLDTHWAIT, M.D.,
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The following case is reported in order to emphasize the importance and possibility of operation for the drainage of abscess in the posterior mediastinum when its presence by pressure causes serious symptoms. It has been my fortune to see four cases in which abscess in this region was diagnosed in connection with Pott's disease. Three were children and one an adult. Three—two children and one adult—died suddenly, the death being due apparently to pressure upon the heart or the vagus nerve. In one case—the one reported here at length—the symptoms disappeared with the drainage of the abscess, and the child is now well as far as this feature is concerned. In the case of the adult operation was attempted, but the abscess was not located with the first incision, and the patient's general condition was so poor that at that time it did not seem wise to do more. In the light of later experience it seems probable that had the operation been carried through the patient's life might have been saved. In the two other cases death came suddenly while the children were in bed and during a paroxysm of dyspnœa. The death of one of these children occurred the night previous to the morning on which the operation was to have been performed, and should emphasize the fact that no delay should be allowed after the condition is once determined.

The chief symptom in these cases upon which the diagnosis has been based is dyspnœa, paroxysmal in character, with more or less

of the tubular or metallic breathing that is seen in acute laryngitis. The attacks pass off after a comparatively short interval, at times leaving nothing to show for them, while at other times the laryngeal quality of the breathing persists. At such times the action of the heart is rapid and somewhat irregular. The attacks recur without, so far as can be determined, any reason, and have been repeated in the cases here reported until, with three of the patients, death occurred in one of the attacks. With the other child the attacks were entirely relieved by drainage of the abscess. The heart, lungs, and throat in all of these cases have failed to show any evidence of disease that could produce such symptoms.

In one other case a similar condition was present, only the attacks were so mild that operation was not deemed necessary, and the child gradually improved, the attacks entirely disappearing under bed treatment with the spine hyperextended. It seemed probable in this case that a small abscess was present which was gradually absorbed.

In all of these cases the upper dorsal region was the seat of the osseous disease.

In such a condition the abscess apparently lies in front of the spine, usually more to one side than the other, and, as was demonstrated in a pathological specimen shown before the Association several years ago by Dr. Bradford, the heart and trachea are both pushed forward.

The child upon whom the operation was performed was five and a third years of age, and had had disease in the region of the third and fourth dorsal vertebræ for one year. During that time mechanical treatment had been followed with reasonable care, and it was while the child was at the Convalescent Home in connection with the Children's Hospital that the attacks of dyspnœa and noisy breathing began. At first the condition was supposed to be croup; but as the attacks persisted, and as the larynx was normal, the child was sent into the hospital. A diagnosis of abscess in the posterior mediastinum was made, and soon after, March 30, 1901, the operation was performed. This consisted of a longitudinal incision, about three inches long, just outside of the transverse processes on the right of the spine opposite the seat of the disease. A rib was exposed close to the transverse process and just below

the apex of the kyphos. The periosteum was separated, and about one inch of the rib was removed. Through this—going in behind the pleura—the spine was explored, but the abscess could not be made out. The spasmodic and rapid breathing made it impossible to differentiate between the inferior vena cava and the abscess.

At this time the child collapsed and was supposed to be dying. Realizing that the only hope lay in draining the abscess which was causing the pressure, with a director a quick opening was made directly into the seat of disease in the spine. From this opening was discharged a small amount of pus. A gauze wick was passed into this opening, a gauze pad placed over a small opening which had been made in the pleura, a loose outside dressing applied, and restoratives administered.

The child gradually rallied, the breathing improved and became normal three or four days later, when there was quite a profuse discharge from the wound. After this the convalescence was uneventful. At the end of five or six weeks a plaster-of-Paris jacket was applied, with the spine hyperextended, and since then the child has been about and is doing well.

In light of the operation, the only modification of the treatment in another similar case would be to make the incision upon the left of the spine instead of the right. It seems probable that the aorta could be more easily recognized, and its presence would cause less inconvenience than the vena cava, which was hard to positively recognize.

In case the abscess does not present under the incision, puncture of the spine at the seat of the disease is probably the safest procedure, even though it drains the abscess through the neck of the sac, theoretically the least favorable position.

## DISCUSSION.

Dr. Whitman said that he had had two cases, and had noted in each case a peculiar asthmatic breathing. In a case of Pott's disease of the cervical or upper dorsal region presenting this symptom he would expect to find such an abscess. In the case that he

had operated upon, which was complicated by paraplegia, it had been almost impossible to anæsthetize the child. A part of two ribs, with the adjoining transverse processes, had been removed, but the pleura was not found thickened at all. The abscess was found directly in front of the spine, and was evacuated, and while this had given temporary relief, the child had died twenty-four hours later. In another case of the kind he would prefer operating much earlier. In both instances the abscess had been directly in front of the spine, making it very difficult of access. In such cases, by keeping close to the vertebral body, one need not open the pleural cavity.

# DEFORMITY ARISING FROM INJURY TO THE LOWER EPIPHYSIS OF THE TIBIA.

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Case I.—In 1890, a boy, aged eleven years, had a gradually increasing deformity of the left foot. The following history was given: At two years of age he had disease of the tibia requiring operative intervention. The anterior surface of the leg was marked by cicatrices. The foot was carried inward, so that the body-weight was transmitted to the ground along a line descending to the outer border of the foot. This deformity was observed to increase constantly, and the disability was more marked as time passed. The explanation which suggested itself as the causative factor in this increasing deformity was a relative shortening of the tibia in its relation to the fibula. This relative shortening resulted, no doubt, from the inflammatory affection of the bone in infancy, which had caused a synostosis at the junction of the lower tibial epiphysis with the shaft, and consequent relative loss of growth in length of that bone, while the fibula made its normal increase in length.

Operation. A section about one inch in length was removed from the fibula, subperiosteally, at a point about three inches above the end, and the tibia was cut through at the same level and the foot moved outward in its relation to the leg to its normal position. On account of the boy's age it was thought that the deformity would recur; hence the epiphyseal cartilage was removed from the lower end of the fibula. Healing was satisfactory and the result gratifying, the boy having a well-placed foot, with about two inches of shortening. Some years subsequently it was found that the foot retained its corrected position, and that the measures adopted had been entirely successful.

Case II.—T. W., aged sixteen years, while playing in a barn three years previously, had jumped from a height, fracturing the leg near the ankle. The adjustment of the fracture and recovery were uneventful, the leg and foot being found in a good position, with normal movement. After the lapse of nearly a year it was found that the foot was disposed to turn over upon its outer border,

and this tendency increased constantly as time passed until, at the end of three years, the foot could not be kept directly under the transmitted body-weight, and walking was becoming increasingly difficult.

Diagnosis. It seemed manifest that either the primary injury consisted of a separation of the tibial epiphysis, or that the process of healing in a fracture near the epiphyseal junction had caused premature osseous union between the diaphysis and the epiphysis.

Operative measures similar to those employed in Case I. were carried out, with the exception that the age of the boy precluded the necessity of removing the epiphyseal cartilage from the fibula. The result is highly satisfactory.

Case III.—Norman T., aged eight years, when playing in a harvest field, four years previously, had run in front of the knives of a reaping machine, which cut the leg just at the ankle-joint, so that the only structures left uninjured were the tendo Achillis and the nerve, bloodvessels, and tendons behind the inner malleolus. The surgeon in attendance found that numerous pieces of bone had been shaved off. These were removed and the suturing of nerves and tendons carefully done. Healing was satisfactory and the result excellent, the foot being in good position and having good movement. After a considerable period an inward displacement of the foot was observed similar to that described in the former cases. So far as I know there has been no operation performed as yet for the relief of the deformity in this case. I have not found in the literature to which I have had access any reference to deformity caused in this manner.

## DISCUSSION.

Dr. G. G. Davis said that he had recently had under his care one which resembled exactly the case just exhibited, but it had resulted from an old caries of the lower portion of the tibia. The carious process had long since ceased, and the foot had been left in the same position represented by this cast. He had done a wedge-shaped resection, base outward, and had pushed up the outer part of the foot. The result was satisfactory.

Dr. Coolidge, of Chicago, said that he had broken his ankle when a boy of six years, by catching in a picket fence, and sustained a fracture of the epiphysis. The tibial epiphysis was destroyed by the bony union. The fibula, however, retained its power of growth. The result had been a deformity like that shown in the cast, and a shortening of one inch and a half. The fibula had grown down until it almost touched the ground. The

shortening was interesting as explaining the amount of growth at the lower as compared with the upper end of the tibia. He had estimated that the increase in length from six years of age should have been six inches, and that the relative growth was therefore three to one in favor of the upper end of the tibia. He had also seen a case, similar to the one reported, which had occurred not from fracture, but from caries. This had prevented the growth of the epiphysis of the tibia. At the time of the operation the child was seven years old. He had done a resection of part of the fibula, but had not resected its epiphysis, so that the growth undoubtedly recurred somewhat. A person could get along fairly well with a certain shortening of the leg due to lack of growth of the tibia. It seemed to him better to do this than to stop the entire growth of the lower epiphysis.

Dr. A. H. Freiberg said that several years ago he had reported in the *Annals of Surgery* a case that he had observed of congenital deformity of the ankle simulating, at first glance, the ordinary equino-varus. Examination showed it to be due to deformity above the ankle. At that time he had considered the case to be one of intra-uterine separation of the epiphysis, with subsequent healing. He had done in that case practically the same operation described in the paper, except that he had not removed the lower epiphysis of the fibula. The leg had been made straight, but subsequently the deformity had recurred. The child died from acute cerebro-spinal meningitis before another operation could be done.

Dr. McKenzie said that the case reported was due to caries at the age of two years. When seen by him at the age of ten or eleven the operation for correction had been necessary. He had not removed the epiphysis of the fibula, but the epiphyseal cartilage, because of the age of the boy. Growth would naturally continue for about ten years longer, and the deformity would recur unless this was done. The boy still had a good foot, the operation having been done ten years ago. In another case—a boy, aged seventeen years—he had done nothing more than correct the deformity. On removal of a section of the fibula and bringing the distal fragment up he had found a space left, but there was a bridge of periosteum, and this space had filled in quite well.

# REMARKS UPON THE TREATMENT OF HIP DISEASE, AND PRESENTATION OF A FURTHER MODIFICATION OF THE HIP SPLINT.

By JOHN DANE, M.D.,
BOSTON.

The question of the proper treatment of hip disease has been discussed before this Association so many times that it would seem almost necessary to begin any paper upon this subject with an apology. The excuse in the present instance is that the presentation of some further modifications in the traction splint, shown at the Washington meeting four years ago, would seem to call for some statement of the advantages that it is hoped have been attained.

Although there have been, and probably are still, considerable differences of opinion upon the subject of traction and fixation, certain facts would seem to have been demonstrated. Theoretically, the spasm of the powerful groups of muscles about the hip must drive the head of the femur against the acetabulum with a very considerable amount of force, and one or both of these structures are the seat of an active tuberculous process. Practically, the results of this pressure have been demonstrated again and again, as shown either in an absorption of the head or in the widening or actual disappearance of the acetabular rim.

To antagonize this spasm, we have both fixation of the joint and traction in an opposite direction applied to the limb. When the patient is properly secured in bed and the limb drawn away from the pelvis by a weight and pulley, traction and fixation are each aiding and are equally important. But as prolonged confinement to the bed is very injurious, and the advantages of fresh air and exercise are so manifest, the question immediately presents

itself of whether it is not possible to provide an efficient amount of traction and fixation in some ambulatory form of treatment. Traction, fixation, and the prevention of the jar caused by walking—these are the three ends that have governed the construction of the various hip splints that are used in America.

As first designed, the long traction splint was intended to serve as a perineal crutch. But while it is mechanically easy to transfer the weight of the body to the perineum or the tuberosity of the ischium, it is not possible to prevent the patient from sinking down into the apparatus at each step to such an extent as to reduce the amount of traction to a point where it is useless to antagonize the muscular spasm. Perineal straps will all stretch to a greater or less extent, and even in thin subjects there is a certain amount of fat and other soft tissues that can be compressed before a rigid point of counter-pressure is met with against the bone. Since elastic traction has not proved successful, it is the custom of many surgeons to try to avoid this difficulty by building up the sole of the shoe on the sound side and providing the patient with a pair of axillary crutches. As long as the extension straps are kept tight and the splint is not used in walking, we are undoubtedly successful in our efforts to maintain traction. But the practical question must ever be, Are these essentials carried out? With the careful supervision of private practice they undoubtedly can be; whereas, in the out-patient clinics of our hospitals, where the great majority of our cases must be treated, they are just as certainly neglected. One has but to watch the patients as they come in or go out of the building to satisfy himself of this beyond the shadow of a doubt.

Such being the fact, we are forced to the conclusion that whatever good the splint does, and it certainly does do well for the majority of cases, it must accomplish largely as a fixation and not as a traction appliance. This at once brings into prominence two questions: First, as to the necessity of fixation; second, as to the amount of fixation that can be secured with such splints. In discussing these questions it is well to recall that the inventors of some of the most widely used of the traction splints did not even aim to immobilize the joint; "motion without friction" was then supposed to be a mechanical possibility, and the theory

that "motion within the limits set by Nature" was an advantage rather than an injury to the joint was a guiding principle with some of the ablest advocates of ambulatory treatment.

Although it is both to be feared and hoped that we are still a long way from a full understanding of this subject, yet the trend of recent investigation and teaching seems to be all in one direction. On the one hand, demonstrations such as those of Phelps[1] tend to show that absolute fixation of a joint does not cause ankylosis; and on the other, there is the ever-strengthening opinion that physiological rest is the best treatment for all tissues when in a state of acute inflammation. That this principle is generally recognized is clearly seen from analogy. Turning to the various pieces of apparatus devised to aid in the treatment of active tuberculosis of joints other than the hip, do we find any that are intended to permit of an arc of motion? Ankle, knee, spine, elbow, wrist: is it not our aim to secure as nearly perfect quiet as we can for the inflamed structures? For example, in applying a plaster-of-Paris bandage in a case of acute tumor albus, do we not extend it as far up the thigh as possible, and in many cases include even the ankle and foot in the bandage in order to render the immobilization of the diseased joint just as absolute as we can? I cannot believe that the best treatment for disease of the hip forms the single exception to so general a rule.

If, then, fixation is such a necessary part of the function of the hip splint, the second question becomes one of great importance —namely, How much fixation do the various forms of hip splint furnish? To bring before you the results of some investigations upon this point is one of the main objects of this paper. The only statistics that I have been able to find are those published by Lovett[2] twelve years ago. His experiments were made with a "Taylor hip splint of the ordinary pattern with one perineal strap." In order to obtain a record, "the shaft of the splint was extended up by an adjustable appliance two or three inches, and terminated in a clamp carrying a pencil at right angles to the skin, which touched the skin covering the ilium just below the crest." Thus any motion between the pelvis and hip would be indicated

[1] Post-Graduate, April, 1897.

[2] Transactions of the American Orthopedic Association, vol. i. p. 193.

by a mark upon the skin, the length of the line being a measure of the amount of the motion. Using a boy of ten years for a model, he found that, in a normal hip, a traction of three pounds and a half exerted by such a splint allowed an arc of motion of 35 degrees at the joint when the boy got up or sat down. In "an older boy" the motion under similar conditions was 40 degrees. By increasing the traction to eight pounds, "when it became almost unbearable," the arc was limited to 15 degrees. He says that a "Taylor hip splint with a rigid pelvic band and two perineal straps furnishes much more complete fixation," but gives no figures or experiments bearing upon the point.

The method followed in my own investigations was that suggested by Lovett, with the trifling addition of a piece of adhesive plaster fastened to the skin over the area where the point of the pencil was to travel. An extension of about three pounds and a half was applied by means of a windlass in each case. The first splint used was the customary Taylor hip splint, having rigid pelvic bands and furnished with two perineal straps. The results can be briefly stated as follows:

1. Girl, six years old, normal hip-joint; arc of motion equal 22 degrees.

2. Girl, five years old, hip disease; 65 degrees motion in flexion; arc of motion equal 16 degrees.

3. Boy, six years old, hip disease; 30 degrees motion in flexion; arc of motion equal 27 degrees.

As one of the deductions from these figures, I would raise the question of the advisability of treating all cases of hip disease, regardless of the arc of motion permitted by the muscular spasm, by means of a splint that does not restrict motion to less than an arc of 16 degrees and varies from that to 27 degrees.

The next tests were made with a splint similar to that shown in Washington four years ago,[1] with the following results:

1. Boy, five years old, hip disease; motion in flexion, 40 degrees; arc of motion equal 11 degrees.

2. Boy, six years old, hip disease; motion in flexion, 100 degrees; arc of motion equal 9 degrees.

[1] Described in TRANSACTIONS OF THE AMERICAN ORTHOPEDIC ASSOCIATION, vol. x. p. 223.

With one exception (the normal hip) these were cases as they presented themselves at the out-patient clinic, the splint being adjusted by the parent. While these figures show a distinct gain in the amount of fixation, they would seem to prove that a certain, not inconsiderable, arc of motion is still permitted at the hip-joint.

Looking more closely at the mechanical principles involved in these splints, it is an easy matter to see the portion that is least efficient. Below the line of the joint, the long lever formed by the leg is fastened securely to the splint—especially in splints provided with double uprights, the fixation of the leg leaves little to be desired. It is almost the reverse with the upper, or pelvic, arm of the lever. Not only is this arm relatively very short, but its grasp of the pelvis is extremely imperfect and restricted in most splints to a belt very little over an inch in width. The simplest way of obviating this difficulty would seem to be to lengthen the upper arm of the lever by extending the outside upright of the splint as far as the axilla, and the first splints with which I experimented were all provided with a thoracic extension. But it is obvious that such a thing as a rigid grasp of the thorax is impossible from the necessity of permitting motion for the ribs during respiration. The grasp of the chest is even less satisfactory than that of the pelvis, and without a fixed point for the upper end of the splint a thoracic arm serves only as a lever by which all of the motions of the trunk are transmitted directly to the hip-joint. It is maintained by Whitman, in his admirable *Text book of Orthopedic Surgery* (page 278), that "as a matter of experience, however, it will be found that motion of the upper part of the trunk is absorbed, as it were, in the flexible lumbar region of the spine before it reaches the joint." I regret that I am unable to agree to this view. The compensating action of the lumbar spine, a region that has been so aptly designated "the third hip-joint," is, I believe, only possible when left perfectly free and unhampered by any apparatus. When wearing a splint that extends beyond the lumbar spine it is impossible for the patient to sit in any ordinarily constructed chair. He tries to perch on the edge of the seat as best he can, and aids himself by twisting and bending the thorax as much as the apparatus will permit. The thoracic motion and jar must, it would seem, be transmitted

through the splint to the hip, and practically, in my hands, the results of such a splint were so unsatisfactory that after a trial of

FIG. 1.

nearly two years I had to remove all the thoracic extensions, and have since confined myself to such modifications as would secure a more accurate and firm grasp of the pelvis.

The lower portion of the splint here shown is the same as my former splint. The pelvic portion is modified by the addition of a second posterior pelvic arm. The lower arm is carried as far down as possible over the sacrum; the upper follows closely under the curve made by the crests of the ilia. Each of these arms is prolonged around the opposite or sound side of the pelvis

Fig. 2.

by means of a strip of flexible steel riveted to its free extremity. To these in turn are riveted the outer ends of the webbing straps which complete the circuit by passing through buckles in the single rigid anterior pelvic arm of the splint. The padding consists of a thick piece of leather, a little wider than the pelvic arms, and riveted firmly to them and to their flexible extensions.

It is free only as a flap under the space occupied by the straps and buckles. The advantages of these additions, both as to fixation and as to adaptation, are too easily seen to demand any further comment. To determine the practical efficiency of the new splint, it was applied to a child of three years and a half having a normal hip-joint, and tested in the usual manner. The result showed an arc of motion of only 6 degrees. It must, however, be remembered that this was a newly and carefully applied splint, and it has yet to be proved whether as much fixation as this can be secured in the ordinary clinic cases.

For the treatment of the most acute and refractory cases a combination of a traction splint worn over a leather spica has been advocated. The immobilization from this should theoretically be distinctly greater than that afforded by the splint alone, and from the satisfactory behavior of a series of bad cases that I have seen treated in this way by Dr. Lovett, I am led to believe that this is true in fact. Unfortunately, I have been unable to demonstrate this in figures, for the method employed would necessitate the cutting of a window in the leather splint just under the iliac crest. An experiment made with a plaster-of-Paris spica applied over a Taylor splint, and not giving the best of fixation, showed an arc of motion of 6 degrees. This leads me to expect that one applied in the proper manner should limit motion to at most a very small arc, and that this would prove a most serviceable method of treatment for all cases that do badly with the splint alone.

# THE TREATMENT OF ACUTE HIP DISEASE, WITH THE DESCRIPTION OF A SPLINT.

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It is a generally accepted rule in surgery that a joint in a state of inflammation is better at rest than it is exercising its function of movement. In the chronic inflammation of joints nature hints at a line of treatment by fixing the joint by a reflex muscular contraction which limits or abolishes motion, and this constitutes her method of cure. In many—indeed, in most—cases of joint inflammation fixation remains the chief therapeutic means at our disposal, leaving out for the moment the question of operation.

In the hip, however, traction has been found to be a most useful means of treatment in hip disease, and its adoption by American surgeons has led to its being called the American method. In America it has been generally adopted as a routine means of treatment in the form of the Davis-Sayre-Taylor traction splint. In Europe traction is more or less used, but fixation holds much more of a place than here, and even here attempts have been made at a combination of fixation with traction by Phelps,[1] Blanchard,[2] Dane,[3] myself,[4] and others. But, on the whole, the long traction splint has held its place undisturbed, and one has heard comparatively little of the importance of fixation in American writings on the subject until recently.

In view of the recent discussion in Europe as to the place of excision of the hip in the treatment of hip disease, and the widely differing views held on the subject there and to a certain extent

[1] Phelps. New England Medical Monthly, January, 1892.
[2] Blanchard. Transactions of the American Orthopedic Association, vol. vii. p. 230.
[3] Dane. Boston Medical and Surgical Journal, January 15, 1897.
[4] Lovett. Transactions of the American Orthopedic Association, vol. i.

in America, it seems worth while to look more carefully at the conservative treatment of hip disease in order to formulate and carry out the most efficient plan of conservative treatment obtainable. By the perfection of the conservative treatment alone can its true place be estimated. The criticism that in America traction has been allowed to occupy too prominent a place as the chief means of treatment of hip disease, and that fixation has been too little considered, is not without foundation. It may, therefore, be useful to try to estimate the relative value of these two therapeutic agents and to investigate the efficiency of various forms of apparatus in regard to these two elements.

It would, I think, be generally admitted that the unrestricted use of the hip-joint in hip disease was undesirable, and that some artificial limitation of motion should be imposed. Most orthopedic surgeons would further agree that no more motion at the joint should be allowed by the apparatus than nature indicated by the amount of muscular spasm that she imposed; that is, if in flexion the diseased joint could only be moved through 30 degrees, apparatus which permitted motion through 40 degrees could hardly be regarded as efficient. Shaffer[1] has made the statement that "motion made within the limit set by nature is not harmful." Whether or not this is true, or whether or not as complete fixation as possible of the hip joint may be desirable in the acute stage of the disease, is a matter of opinion; but probably all orthopedic surgeons would agree that motion beyond the limit set by the reflex spasm was in general harmful or at least undesirable. All this deals with the question of fixation as a therapeutic measure.

Traction is no less important than fixation. It has been shown experimentally that in both the normal and diseased joint a bearable amount of traction can separate the head of the femur from close contact with the acetabulum.[2] It has been demonstrated by pathological evidence that wearing away of the head of the femur is less evident in cases treated by traction than in cases treated without it. It has been demonstrated clinically that trac-

[1] New York Medical Journal, November 23, 1899.
[2] Bradford and Lovett. Children's Hospital Report, 1895.

tion relieves pain, quiets muscular spasm, and is agreeable to most patients with acute hip disease.

There seems to be no question as to the advisability of the use of traction in most cases of hip disease. Believing as I do that what we call hip disease at the present is merely the name for a composite group of cases of varying pathological origin of which tuberculosis is only one, I believe that in the future, when we can differentiate the forms of the disease, traction will not be universally necessary; yet at the present time the danger would lie in using it too little rather than too much, and as an advocate of the general use not only of traction, but of strong and efficient traction in acute hip disease as we now know it, I desire to go on record.

Fixation as contrasted with traction as the sole treatment is inferior to it, but it is not incompatible with traction, and, although fixation does not distract the joint or prevent the wearing away of the head of the femur, it does, as we all know, both in itself and in connection with traction, quiet joint inflammation. Why else do we put to bed and fasten to a frame patients with irritable hip disease? We add fixation to traction at that time, but only too often, when we are driven to it. How common is the experience, in cases treated by ambulatory traction splints under these conditions, to see night-cries disappear, joint irritability diminish, and the arc of motion increase; yet what have we done but add fixation to traction?

Traction, therefore, would seem to be a desirable and reasonable element of treatment in acute hip disease, but with it should be combined enough fixation at least to limit the arc of motion well inside of that set by nature, as shown by the amount of muscular spasm present in the joint, if not to afford all possible fixation to the joint.

This paper is a plea against routinism in the treatment of hip disease. If one believes that motion within the limit set by nature is not harmful, then the apparatus used in each case should limit the arc of possible motion while wearing the splint well inside of that limit. No one form of traction splint is suitable for every case. If one believes that no motion should be allowed in the diseased joint, then the spica traction apparatus should be used

as probably affording better fixation than any other. We are likely to err in the direction of allowing too much rather than too little motion. Recumbency we all avoid for long periods on general grounds, yet we all know that, in general, the irritable joint itself does better when the patient is recumbent than when he goes about wearing the ordinary long traction splint.

As to the efficiency of different forms of traction apparatus in the amount of fixation that they furnish, there is a certain amount of information at our disposal. The traction splint, it must be remembered, was devised to allow motion without friction, and its present form is not radically different from what it was then.[1] Allowing all due weight to Judson's theory[2] that the perineal band acts as a brake upon a wheel, the fact remains[3] that the traction splint with one band applied with three and a half pounds of traction affords fixation only at the ends of an arc from 35 degrees to 40 degrees long. With an amount of traction "almost unbearable" the arc was reduced to 15 degrees. Dane has shown in his paper in this journal that the traction splint with the rigid waist band and two perineal bands allows from 16 degrees to 27 degrees of motion with three and a half pounds of traction; that his hip splint with one band allows from 9 degrees to 11 degrees of motion; that his splint with two bands allows 6 degrees of hip-joint motion. The spica apparatus described in this paper probably allows a few degrees of motion, but approaches nearer to complete fixation than any other apparatus. No satisfactory experiment was made on this point.

Complete fixation of the hip joint, therefore, seems unobtainable by ambulatory traction or other apparatus, as would be expected on general grounds.

Those who use one splint, for instance, the long traction Davis-Sayre-Taylor splint for all cases impose an arbitrary limit of motion of a certain number of degrees under ideal conditions (and probably the splint is not more than half as efficient in fixative power under the conditions of ordinary use) upon all cases of hip disease, whether they allow 5 degrees or 50 degrees of motion in flexion.

[1] American Medical Monthly, 1859, p. 361.
[2] Medical Record, July 7, 1883.
[3] New York Medical Journal, February 8, 1889.

Again, in hospital work, we must all recognize the fact that it is questionable how much real traction is exercised by the splints as applied in daily use at home. For this reason it is worth while

Leather spica traction splint.

to emphasize the importance of using apparatus which of itself affords fixation not dependent on the amount of traction exerted.

Why cases of hip disease differ so widely we do not yet know, and we shall not know until a more careful study of the disease

is made. We do not yet know how to distinguish with any accuracy acetabular from femoral disease. We cannot, in most cases, clearly separate traumatic or other synovitis, tuberculous hip disease, osteomyelitis, arthritis deformans, syphilis, etc., from each other, and, for the present, we must treat by symptoms and be guided by them.

For the treatment of severe hip disease allowing less than 20 degrees or 30 degrees of motion in flexion, I believe that the best possible fixation should be combined with traction. For that purpose I have used in such cases for the last year a combination of a spica bandage and a long traction splint with the most gratifying result. For a permanent splint I have found it best to use a sole-leather spica which reaches from the upper chest to the calf. This is stiffened by painting with hot bayberry wax. Outside of this is attached a skeleton long-traction splint. No further explanation is necessary. This splint is applied in the class of cases described, and has proved most satisfactory. It is so closely applied to the chest and the trunk that it affords a fair fixation, to which the traction contributes. Patients are not allowed to remove it oftener than once a week, and are required to keep it on for two weeks at a time if possible. Its disadvantages are obvious. The patient cannot sit with comfort in an ordinary chair; it is hot and dirty, and the plaster extension is likely to become a source of irritation; but it limits motion sharply, it makes walking on the splint difficult and unlikely, and if traction is not efficiently kept up the child, at least, has the advantage of fixation.

Traction splints which have an arm embracing the thorax, in the hope of affording better fixation, have one intrinsic objection. They cannot be firmly attached to the chest, whereas they can be firmly attached to the leg. The twists and turns which the thoracic band makes are transmitted through the hip joint to the firmly fastened leg, thereby irritating and disturbing the sensitive hip. Such, for example, is the objection to the splint that I described some years ago[1] (which was a combination of the Taylor and Thomas splints) and to similar splints. Traction apparatus, on

[1] Transactions of the American Orthopedic Association, vol. i.

the other hand, which aims at securing a better hold on the pelvis, avoids this criticism. I am quite aware that the spica splint differs in no essential from some splints in use. It is rather more permanent than plaster-of-Paris, and I am making it only a text for a paper on the importance of intelligently adding fixation to traction.

The use of this combination splint has enabled me in the past winter to do away in large part with treatment by recumbency for deformity and sensitiveness coming on in the course of hip disease, and now recumbency is limited in cases coming under my care to those in which the patients have been recently operated upon for abscess and to cases with so much irritation of the skin that an efficient application of sticking-plaster is not possible.

The routine has been as follows: If a case with deformity or sensitiveness, no matter how severe, is admitted for bed-treatment to the wards, the traction splint is put on and over it a plaster-of-Paris spica bandage reaching from the axilla to the calf. If the leg is adducted or abducted or flexed the spica is made to hold the leg in the position of deformity, and no attempt at correction is made at the first bandaging. At subsequent bandagings the deformity has been found to have been corrected just as it would have been by recumbent treatment and its gradual reduction by traction. One of the later plaster spicas, when removed, is used as a mould for the leather spica.

Since the summer of 1900, by the kindness of my colleagues, to whom I am indebted for permission to publish their cases, all cases of hip disease entering the Second Surgical Service at the Children's Hospital have been transferred to my care. They have practically all been treated by the method described. It must be remembered that only cases have been admitted to the wards which were doing badly under ambulatory treatment with the long traction splint in connection with a high shoe and crutches, so that the cases commented on are, in general, the worst ones in an out-patient clinic having under treatment some hundreds of cases of hip disease of all grades. No cases have been omitted from this mode of treatment except those of some very young children and, perhaps, one or two others for some special reason not connected with the disease. I have the records of fourteen

cases treated by this method in the last few months. The series is not, I think, worth giving in detail, and a few sentences will give the important points.

In two cases there had been no previous treatment by traction, but in the twelve others the use of the long traction splint had failed to control the symptoms. In all the cases, with one exception, where there is some circulatory trouble in the leg necessitating recumbency, and one in which excision was performed, the patients are now up and about, and most of them have better motion at the hip than they had when the apparatus was applied, and it must be remembered that in these cases there was little treatment by recumbency, one object being to get the patient about as speedily as possible. In no case has the apparatus failed to control night-cries when properly applied. One patient was reported to have had night-cries in spite of the apparatus, while in the hospital wards, but the traction straps were found to be loose, and when they were tightened the night-cries disappeared. Twice I have been able to control night-cries which had persisted during treatment by traction and recumbency, where every expedient had been tried, by the application of this splint and getting the patient up. In two bad cases the patients were up and about the ward in the splint, doing perfectly well for some days, and were discharged to their homes, but had to be readmitted later for irritability of the joint. The parents in both cases were ignorant and careless foreigners, and probably misused the splint. In both cases the apparatus at once gave relief when the patients were readmitted and were under the supervision of competent nurses.

In one case only has abscess occurred, and on opening the joint it was so seriously diseased that the head of the femur was removed. This case was far advanced and extremely acute when the apparatus was first put on. After a while, by a misapprehension, the spica was removed and the ordinary treatment resumed. The acute symptoms returned and the apparatus was again applied, but in a few weeks abscess appeared. In two cases fluctuation over a considerable area was present when the apparatus was applied. In one it has now disappeared, in the other it is less. One case is, I think, worth speaking of more at length:

Clarence D., aged six and a half years. Hip disease began in the fall of 1899. The long traction splint, high shoe, and crutches were used in June, 1900, and treatment was continued from that time on at the out-patient department. The parents were careful and intelligent. In September, 1900, the patient was admitted to the wards for sensitiveness, night-cries, etc., and discharged in a few weeks to the parents, wearing a long traction splint.

*November 7th.* Readmitted for the same reason. There were 5 degrees motion in flexion, permanent flexion 20 degrees, and eversion, very sensitive, much thickening about the hip. Leather traction spica splint applied, and the patient discharged November 19th.

*December 7th.* Has 30 degrees motion, no deformity; fluctuation over outer aspect of thigh. Circumference at groin $12\frac{1}{2}$ inches, less sensitiveness.

*May*, 1901. Has 40 degrees motion, no deformity; hip not irritable; circumference at groin $10\frac{3}{4}$. Fluctuation entirely gone. Child has been about actively since December. Thickening about hip slight; eversion has disappeared.

The cases are not in any way remarkable, but have, on the whole, done well, and, in my experience, much better than any similar cases that I have ever treated.

The conclusions which I would present are as follows :

Cases of hip disease permitting not over 25 degrees of motion in flexion, or extremely irritable cases, should be treated by the best obtainable fixation plus traction. Treatment by recumbency is not generally necessary even in the most acute cases if the apparatus described above is applied to the hip in the position of deformity. This deformity generally disappears under this treatment. The splint should be removed as seldom as possible, and the hip should not be disturbed by frequent examinations.

Cases allowing 25 degrees to 45 degrees of motion in flexion may be treated by Dane's splint, with high shoe and crutches, in preference to any other form of traction splint. Personally, I should extend the use of the spica traction apparatus to most of these cases in the hope of shortening the disease by overefficient treatment, but that position could perhaps not be successfully defended.

The use of the Davis-Sayre-Taylor long traction splint, with one or two perineal bands, should be limited to cases allowing well over 45 degrees of motion in flexion, and should be used with high shoe and crutches, to prevent the intermittent traction necessarily incident to walking on the splint.

It is probable that the more rational use of combined traction and fixation would lead to better results in conservative treatment in shortening the disease and improving the functional results than can be obtained by the routine use of traction.

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## DISCUSSION.

Dr. Whitman said that this paper was of particular interest to him, because it was an evidence of a change of opinion and of practice in Boston. He had been impressed, on visiting the Children's Hospital, with the fact that the ordinary traction brace seemed to be used as a matter of routine whether or not the cases were acute or chronic, and whether deformity were present or not. As far back as 1892, the speaker said, he had applied the plaster spica beneath the ordinary hip-splint, and had employed this method more or less ever since. He had also applied a short Thomas hip-splint, to be used in connection with the traction hip-splint. He believed thoroughly that fixation in connection with traction was the treatment for hip disease, whenever its articulating surfaces were involved, without regard to the severity of the disease or to the range of motion. He would certainly not approve of the suggestion that one might allow motion to the limit set by nature. This seemed to him an absurdity. In nearly all of the cases of hip disease in the early stage there was almost free motion in the joint. The ordinary hip-splint limited the motion to 20 or 30 degrees, or far within the limit of nature; yet under this treatment the range of motion became more and more restricted, until finally, in a large proportion of cases, it was lost altogether, as illustrated by the series of cases published by Dr. Shaffer and Dr. Lovett. The form of apparatus shown was a very good one, and the apparatus devised by Dr. Dane was better than the ordinary traction apparatus because it gave better fixation.

Dr. Ridlon said he was very much pleased with the statement of facts presented by Dr. Lovett. Some years ago, Dr. Ridlon said, he had embraced the doctrine of fixation alone as opposed to the use of the long traction splint with very limited motion. Of late years he had used traction in many private cases, and had wanted to use it in some charity cases that could not afford to have traction apparatus. He thought we could safely accept the rule that whatever would most rapidly relieve the pain and muscular spasm should be the form of treatment to be employed. In practically all cases in his experience fixation to a greater or less extent was necessary in hip disease. Traction was necessary in a considerable number, or at least was a very great addition to fixation in a very considerable number of cases of hip disease; but he had reported two cases, and had seen three or four more, in which traction increased the pain and the muscular spasm. In such cases traction was certainly contraindicated, he was positive, just as much as it was indicated in other cases. Many splints used for fixation and traction do not fix the joint in the greatest possible degree of hyperextension. The main tendency toward deformity in hip disease was toward flexion deformity. To fix the hip the limb must be carried to the fullest possible hyperextension and lashed fast in that position. Practically all the men in England, with the exception of the immediate students of Thomas and those in this country using the Thomas splint, had not used it with the idea of keeping the limb in the fullest hyperextension. The splint had been curved too much, and the leverage had not been great enough. If he would criticise the splint presented it would be in the same way as he would criticise a plaster-of-Paris spica, *i. e.*, it does not give the fullest possible hyperextension. He had been afraid to put on a casing of plaster or leather around the thigh and let the patient walk upon this casing, fearing that the thigh would wedge into the casing, and that the weight of the patient would push the femur upward into the acetabulum to a harmful extent. He had felt that if some form of spica were going to be used that we must use the weight-carrying apparatus as a separate apparatus, because it would yield a little in spite of all precautions, and the leg would sag down. Dr. Lovett showed that this fear was without foundation. He entirely

agreed with Dr. Lovett that it was impossible to make a diagnosis of synovial disease with any approach to certainty without the aid of an X-ray picture.

Dr. Ridlon then presented a radiograph of an interesting case —that of a woman, aged twenty-four years, who at times only had had some limp and rigidity. The case had been referred to him by Dr. E. W. Andrews. The latter had been in doubt for four years about the true nature of the case. When seen by Dr. Ridlon there was flexion deformity of 35 degrees, with limp, but no special sensitiveness. It was possible to flex the thigh almost to the normal, and the rotation was somewhat increased. He had been in doubt about its being hip disease, but on studying the radiograph the extent of the disease in the capsule and in the acetabulum was evident, although the head of the bone was not apparently involved.

Dr. Wallace Blanchard, of Chicago, said that six years ago he had presented to this Association a splint intended to immobilize the hip joint and at the same time to produce traction in a direction with the axis of the neck of the femur. At that time he had stated that it was his experience that in the great majority of cases of hip disease in which there was much flexion the application of this splint would relax the contracted flexors, and the night-cries would usually cease within the week. His theory was that the injury to the acetabulum was produced by friction, and that to advantageously relieve friction one must relieve as far as possible both movement and pressure, the two factors of friction. The orthopedic surgeons who, like Thomas, relieve only movement, eliminate at best but one factor of friction, and the same is true of those who only attempt to relieve the pressure in the joint by use of the traction splints. He believed the antifriction treatment to be the ideal one, and he was glad to see the time at hand when the tractionists and fixationists would acknowledge that each was right and would join together for the relief of friction.

Dr. G. G. Davis expressed his gratification that the opinion was gaining ground that two side-irons are better than one side-

iron in the hip-splint. Dr. Dane's hip-splint has the two side-irons. The character of the apparatus employed depended upon the time at which ambulatory treatment was considered advisable. Ambulatory treatment of fractures had been advised, and it certainly could be carried out in practice, but the advisability of doing so was questionable. The confinement to bed had been generally admitted not to be so deleterious to children as had been supposed. Where such marked fixation was required as indicated by Dr. Lovett's splint he would be disposed to keep the child in bed until all the acute symptoms had subsided and he could use a splint which would give a less extensive fixation. The Thomas splint was unsatisfactory, as the children could not sit down with any comfort. He had usually made use of a splint resembling the one presented by Dr. Dane, having two side-irons and a band to sit on somewhat like that used by Thomas. The amount of fixation at the joint could be varied according to the personal desire of the orthopedic surgeon. Where greater fixation was desired, then Dr. Dane's double waistband could be added.

Dr. Coolidge said he wished to thank Dr. Lovett for combining the plaster spica with the hip-splint. He referred to two cases that he had seen which had been wearing the Thomas splint. After a while the joint had become irritable, and he had put them to bed, with traction. It had become necessary to employ the plaster spica in addition to the Thomas splint and traction, with immediate cessation of symptoms. After this experience he was disposed to think very highly of Dr. Lovett's splint.

Dr. A. M. Phelps said the brace presented by Dr. Lovett was practically identical with an apparatus published in the *Post-Graduate Journal* in 1897, and was a reprint of a paper presented to the New York Academy of Medicine two years before. The apparatus had been used for poor children. The apparatus he referred to did not envelop the limb, and was more comfortable. It was better to run the apparatus upward and put on two rings. The brace of Dane had been devised by Dr. Plimpton, and had been in use in the New York Post-Graduate clinic for six years, but had not been printed. The ring was the proper thing to use in

all braces in which counter-extension is desired, together with a band to limit antero-posterior motion. Any hip-brace having a strap on the limb could not possibly fix the joint, for the reason that as the limb moved it was bound to move, as it were, in a swing to 25 or 30 degrees. The strap was wrong; the ring was the proper thing. He could see no advantage in cutting away the strap in front and buckling if the ring were properly applied.

Dr. Lovett, in closing, said that the leather of his splint was stiffened by being painted with hot bayberry tallow, several coats being used. It was rather difficult to get the tallow just right. He did not believe that motion within the limits set by nature was necessary, and he thought it quite possible that it was harmful. He would rather avoid it. He did not believe that the ordinary traction hip-splint fixes the joint within 45 or 60 degrees of absolute fixation, and that it was probable that the extent of motion was greater. He had had enough experience with putting these patients to bed and waiting for them to get better, and then, after they had been up for a time, putting them back again. It was pretty good treatment, but he thought there was better. The plaster fixation spica he thought better treatment than rest in bed, in many cases at least. Given a case with acute symptoms, he believed it was better off with a plaster spica than in bed with traction, because fixation is better and the symptoms can be better controlled. With regard to walking on the splint he had been misunderstood by Dr. Ridlon, for none of the children had been allowed to walk upon the splint. With regard to the Post-Graduate School brace, it does not grasp the pelvis or the leg. He had used that brace in another form, with a plaster jacket and traction splint, without pelvic fixation, and had had pretty poor results from it. The brace presented was, of course, not identical with the Post-Graduate brace, and had been devised with the full knowledge of the other brace. He did not think there was anything especially new about the brace, but wished to insist upon the desirability of individualizing in the treatment of hip disease.

# RUPTURE OF THE SPINAL LIGAMENTS: A REPORT OF CASES.

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AND

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We have to report three cases of injury to the spine in which there was kyphosis without tuberculosis or other disease of the vertebræ, in which there were symptoms of pressure upon the cord, which pressure symptoms were relieved, and the patients entirely recovered functionally in the course of a few months after treatment with plaster or leather jackets was commenced.

In addition to two cases reported by Dr. Myers before this Association two years ago we have found thirteen others which, with two or three exceptions, seem to us to be uncomplicated ruptures of the spinal ligaments. In the long bones it is well known that oftentimes fractures and luxations will occur before the ligaments will rupture. This is, we believe, not so generally true in the case of the bones of the vertebral column and its ligaments.

In the cadaver Wagner and Stolper have shown that, with dorsal and cervical muscles dissected off, the spine can be flexed forward so that the chin rests on the breast without any rupture of the ligaments. If, in addition to this forward flexion, there be added some side flexion, the spinal ligaments would give way. It is fruitless, however, to argue from this what would happen to a living being whose muscles were in place and whose trunk was subjected to an unexpected application of force. In other words, we do not place any reliance upon experimental studies upon the cadaver.

The following is the report of the cases above referred to. These represent in the literature all the cases classified by their authors as "injuries to the spine accompanied by ruptured ligaments." This, in their minds, is not intended to include either luxations or fractures, though there are two or three exceptions.

Case I. (McA.)—Female, aged thirty-two years. Has never been a very strong person; had nervous prostration three or four years ago, but has always worked, and for some years has earned her own livelihood. In the spring of 1900 she had measles and was delirious, falling from a third-story window and sustaining a compound fracture of the right leg just above the ankle. At that time there was an injury to the back, which seemed insignificant compared with the injury to the leg. The patient was unconscious for a day or so, and was paralyzed from the waist down for several days, but gradually got back the power. She had a great deal of pain in her back during her stay in the hospital while the fracture was uniting. After her discharge from the hospital the patient got about a little with crutches, but there was great weakness in the back and legs and much pain in the back. She also noticed a projection in the back, which, when first detected, was soft, but subsequently became hard. I first saw her at the Massachusetts General Hospital in August, 1900, when she presented the following symptoms and physical signs:

*Physical Examination:* Heart and lungs normal. At level of eighth dorsal a well-marked kyphos, with muscular spasm. Right leg between knee and ankle three inches short; knee-joint stiff and motion of spine limited by muscular spasm. Much relieved by plaster jacket. Discharged September 8, 1900.

On lying down the kyphos entirely disappeared, as it did also on standing up with trunk hyperextended. It was only when standing unsupported or sitting in a chair unsupported that the knuckle was evident. A plaster jacket gave immediate relief to the weakness and pain in the back, and in the course of three or four weeks she was able to get about of her own accord and care for herself again. There is still a slight, though very much less of a kyphos.

This case illustrates an uncomplicated rupture of the ligaments.

The condition was unrecognized for several weeks. During this time she was confined to bed. The deformity was reducible at will without any evidence of a luxation. Pressure-symptoms were produced by any move that brought out the deformity, and were relieved by reduction of the deformity. Case was entirely relieved by use of spinal support.

Case II. (Traumatic kyphos.)—Male, aged thirty-five years, married. Lost arm and received other injuries on February 18, 1900. While in hospital had severe pain in back during five weeks. After getting home his right foot troubled him by becoming numb and "going to sleep." At night both legs twitch, and has sensations of burning and soreness in leg. Better when lying down, but has been able to walk as much as half a mile.

Similar in most respects to Case I. Indeterminate spinal injury; rupture of ligaments unrecognized for several weeks, during which time he was in bed. Kyphos marked, but almost wholly obliterated by hyperextension. Pressure symptoms thus relieved. Case cured by use of spinal support; deformity persists.

The pain in back returned, and he visited another hospital, where a kyphos was detected in the low dorsal region, and he was referred to Dr. Goldthwait, with whom I saw him.

In this, as in the previous case, the kyphos was much less in the hyperextended position, and a jacket was put on in this position. This at once relieved the numbness and weakness in the legs. This was changed to a leather jacket, and for a time it was possible to bring on his numbness by allowing him to flex the trunk. Under the use of the jacket this has entirely disappeared, and he had entirely omitted the support a year after it was applied, and was at work railroading again.

Case III.—This patient, while standing, was struck in the back of the neck and shoulders by the under part of a slowly moving freight elevator. He was knocked down, sustaining a severe shock and concussion, but his extremities were not paralyzed. In a few weeks he was out and about. He had been a very tall man and quite erect, but after the accident he was considerably shorter, because he could not stand erect. His greatest difficulty in doing

his work was with respiration, not being able to go up a few steps without great dyspnœa. This he noticed was relieved by anything that would hold his head and shoulders back. He liked to get himself in a position where the upper portion of the trunk was held in the maximum position of extension. This was finally successfully accomplished by the use of a leather jacket.

The point illustrated by this case is that the patient sustained an injury to the spine, causing a forcible bending of the column forward sufficient to cause him to assume a stooped position several months after the injury had been sustained. This position was partially correctable. The curve was a long, sweeping one; no sharp knuckle.

Case IV.—This young man sustained an injury to his cervical spine which has given rise to a series of symptoms similar to those in Case II.

Case not included, as it was probably a permanent partial dislocation.

Case V. (Gen. J. D. *Chirurgie und Augn. Bilin.*, 1829, vol. xiii., p. 478.)—Female, aged seventeen years; delicate. Strain in lifting a barrel. The consequences were not felt at once. She was well for six or seven months, then felt violent pain on lifting, referred to the last lumbar vertebra. Pain always recurred on lifting, so that she gave up her occupation and became a seamstress; but pain still continued. Gradually a crooked position began to be noticed. At the end of a year the examination revealed the fact that pressure on either side of the spinous processes was painful, and she was practically confined to bed. Under general treatment she improved. Deformity still persisted, much relieved by a tight corset.

This case is instructive as suggesting a partial ligamentous rupture made complete by a subsequent exertion—the production of a bony deformity, which was relieved, though not obliterated, by a tight corset. In this case it would seem that the gradual development of the deformity without any bone disease being present was most suggestive of a ligamentous rupture.

Case VI. (*Transactions of the Medical Association of California*, 1876–77, p. 176. W. S. Thorn, of San José.)—The

patient—a male, aged twenty-seven years, a miner by occupation—was seated on a board over a pit, and was struck in the region of the scapulæ by a rock weighing several hundred pounds. The body was bent forcibly forward. He fell a few feet into the pit below. Examination showed an anterior curve of the lower dorsal and upper lumbar, the spinous processes bulging forward. Complete paralysis of the lower extremities. By pressure of the hands against the prominence some reduction of the deformity was accomplished; there was still enough curving backward to look like a well-marked case of Pott's disease. Paralysis of motion, sensation, and the sphincters; temperature, 103° F. By fixation in bed the patient underwent gradual recovery. He was unable to walk for eighteen months; then a spinal support like those applied in cases of Pott's disease was used, and the patient could walk at once without canes. At the end of eighteen months he worked without a support in the mine. The deformity was most marked from the eleventh dorsal to the third lumbar, and projected two inches and a half. The deviation of the curve was two and one-half inches. The diagnosis made partial dislocation backward of last two dorsal and two upper lumbar vertebræ.

In this case there is undoubted evidence of partial dislocation, and is cited here only to show that considerable deformity may persist, without causing pressure symptoms, in a case of dislocation where it is difficult to see how there can fail to be a considerable narrowing of the vertebral canal. It cannot be proven in this case that the failure to completely reduce the deformity may not have been due to a fracture.

Case VII. (*New York Medical Journal*, vol. xx., p. 626, 627.) —The patient fell forty feet, and was unconscious for three days. Slight loss of power and sensation in the left leg; no effect on the sphincters. A deep depression could be felt between the first, second, and third lumbar vertebræ, due to a rupture of the ligaments. There was a great deal of pain, the patient being confined to bed. A plaster-of-Paris splint was applied to the back, soon after which he got up out of bed, walked well, and completely recovered.

In this case there is no departure of the vertebræ from their

normal relations. The rupture of the ligaments allowed the fingers between the spinal processes. Immediate restoration of function followed fixation of the trunk. The temporary lack of power and loss of sensation may, of course, have been due to a temporary injury causing dislocation, but may equally well have been due to the flexion force causing the rupture.

Case VIII. (*London Lancet*, 1849, vol. i., p. 312. These are cases of Thomas Wakely, from the Royal Free Hospital.)—Man, aged thirty-four years. He was jammed, in hyperflexion, between a low archway and the seat of a cart. Immediate loss of all motion in the lower extremities, but no loss of sensation. A large swelling over the second lumbar vertebræ at the time of the accident. As this subsided the spinous process of the second lumbar vertebra was seen to be specially prominent. The pain gradually subsided and sensation remained good, but there was no motion in the legs. In two weeks the thighs became flabby and atrophied. There was no pain or pressure over the prominent vertebral. Under galvanism to the muscles of the lower extremities strong contractions took place, and there was a gradual return of power. After nineteen weeks he was up, and resumed his occupation of driving a van.

Another case where rupture of ligaments and partial dislocation concurred, showing that the injury to the cord resulted from the vertebræ being pushed forward against it at the time of the injury, but that the persistence of a partial dislocation is not necessarily competent to keep up the pressure symptoms.

Cases IX and X. (Transactions of the American Orthopedic Association, 1898. Cases reported by Halsted Myers, under the title of "Traumatism of the Spine Simulating Pott's Disease.")—Man, aged forty-two years; had a fall of twenty-five feet, striking on his feet and then bending very far forward. Great weakness and pain in the back, but examination was negative. Could not hold himself erect without support. A month after the accident there was a slight kyphos over the twelfth dorsal and first and second lumbar. A spinal support applied, and cure resulted.

Dr. Myers' case seems to us to be one of pure ligamentous rupture, proven by the fact that the deformity did not exist at the time of the accident, but did some months afterward, having been slowly increasing until checked by Dr. Myers' treatment. Assumption of a fracture which has not united is not necessary to account for this.

A man, aged twenty years, slipped while carrying a weight, and was thrown backward. He felt something give way in the lumbar region, and a sensation of pins and needles in the feet was noticed for a short time. Back gave way five times in exactly the same manner. Examination shows slight kyphos of the twelfth dorsal and first lumbar. The knee-jerks were exaggerated. There was some paræsthesia and twitching of the legs. He was put to bed, a plaster-of-Paris jacket applied, and he recovered.

The author seems to believe that in most of these cases there is an unrecognized fracture, and for the time there is non-union.

Here there was slight kyphos noticed. A pure, uncomplicated rupture of the ligaments would account for this case. There was probably a rupture of the ligaments within the canal, which caused the pressure symptoms because of a slight efflexion. The prominence of the two vertebræ could be accounted for in this way.

Case XI. (*London Medical Gazette*, 1835–36, vol. xvii., p. 936–938. Cases reported by Alexander Shaw.)—Man, aged thirty-two years; a bricklayer. He had a fall of thirty feet. Examination made in bed. Angular projection of the last dorsal and first lumbar, while there was a depression of these vertebræ one inch in depth. The transverse processes were prominent. The pain was chiefly from the other bruises, and was not over the seat of spinal lesion. There was no paralysis; the chief discomfort was that he was unable to stand erect. He assumed the following position when on his feet: He stood beside a low table, and leaned forward with his chest on the table; walked by grasping the front of both thighs, with the knees bent. Six months after the accident he began to work at his former occupation, and walked some distance, although the back was still flexible at the seat of injury and the kyphos still prominent. Feeling of weakness in the back relieved by lying down.

This case is of interest because of the extreme grade of bony deformity without pressure symptoms and the persistence of the fissure at the seat of the spinal injury, which would indicate a failure to unite on the part of the vertebræ if it were a fracture; but the same would be true of the stretching out of a ligamentous rupture which had healed. It would seem as though a fracture could hardly have failed to have given rise to some signs of callus even had it not united.

Case XII. (*Australasian Medical Gazette*, 1884–85, vol. iv., p. 1843.)—Male, aged twenty-nine years. About half a ton was sustained by the arms, shoulders, and back for half a minute. He felt something give way in the back, and became insensible; recovered his senses, was helped home for a mile, and then became unconscious. He was paralyzed from the dorso-lumbar region down. He remained thus for two weeks, and gradually felt sensation returning; and, although weak in the back, he started on a horseback ride, but on returning he was seized by the same paraplegia, and then entered the hospital.

Well-nourished man, paralyzed in the lower half of the body; no displacement of the spine; no control over the bladder or rectum. Electricity, tonics, etc., without relief; tried, for six weeks, application of Sayer plaster-of-Paris jacket. The symptoms improved, and he left the hospital. After eight weeks he was so much better that he removed the jacket and applied an improvised support himself. The symptoms returned. At this time he was given by mistake an overdose of morphine, and died, and at autopsy it was found that the third lumbar vertebra was partially dislocated over the fourth. Spondylolithiasis.

This illustrates the fact that deformity is not necessary for the existence of a dislocation, though it does not prove that dislocation existed at the time of the injury. Rupture of the ligaments may have allowed the vertebræ to slip past each other at some time subsequent to the first injury.

Case XIII. (*British Medical Journal*, 1874, vol. ii., p. 646. Cases reported by Ruckman Godlee.)—A blacksmith, aged twenty-three years, was on the top of a pleasure van, when the driver

attempted to go beneath a low archway. The patient stooped, and was drawn through the arch with the spine forcibly flexed. Dyspnœa. The left leg was paralyzed. Hyperæsthesia. Opposite the spine of tenth, eleventh, and twelfth dorsal vertebræ a prominence, which terminated below in a slight depression. In five days he was much better, and in one month he was discharged convalescent.

This case shows the manner, more or less usual, in which this class of injuries is produced, viz., the force being brought downward upon the partially flexed spine, the two extremities of the column being crowded together.

Case XIV. (*Gazette Méd. de Paris*, 1841, vol. xxxix.)—M. Lasalle reports a case of rupture of the posterior ligament of the spine in the cervical region and intervertebral muscular fibres, from simple muscular action, in a case of acute mania. Death, which followed, was due to hemorrhage into the cord.

In this case there was no fracture or dislocation. No outside influences were brought to bear, and yet rupture of ligaments and hemorrhage sufficient to cause death ensued.

Case XV. (*Western Medical and Surgical Journal*, Louisville, 1841, vol. iv., p. 356. Case reported by Solomon Borland.)—Male, aged twenty years; strong, athletic, and muscular. Roof of a flat-boat fell on the patient, forcing his chest down between his legs upon the floor. The immediate symptoms were violent concussion, insensibility, intermittent respiration, and bleeding from the eyes and ears. Examination showed the spine apparently entire and uninjured except at articulation between the last dorsal and first lumbar. Integuments were here contused; articulation completely torn asunder, and a rupture of the ligaments. The spinous processes were broken off. Articulating surfaces were two inches apart. The patient was turned on the side, and there was an angular projection at this point of 100 degrees; but, to the surprise of the attending physicians, he gradually improved under simple rest treatment flat on his back on a hard surface. In two weeks he sat up; in four weeks he returned on foot to the flat-boat, a distance of half a mile. Thirty-two days

after the injury he was apparently well. There was a slight deformity at the seat of the injury. Up to this time he had done no lifting. Several weeks later, after some slight exertions, there was reported considerable backward curvature at the seat of the lesion. Otherwise apparently perfectly well.

This is the most remarkable of the series, and was observed carefully by two or three competent observers. It cannot be proved that there was no dislocation; but there certainly was a rupture, and the fracture was confined to the spinous processes, so far as known, and for that reason it seemed fair to report it in this series.

Case XVI. (A. Martin, *Zeitschrift für Wunbartze und Geburtschieften*, 1860, xiii. 1–6. Observations of a case of complete baring of the whole ligamentous apparatus between the fourth and fifth cervical vertebræ.)—Male, aged seventy-three years; fell three feet from a carriage, striking on the head. Head bent forward. On sitting up there was almost a right-angle flexion in the neck. Two hard bodies could be felt. Slight lateral movement between the atlas and occiput. Paralysis from third rib down; feeling also gone. Intellect intact; respiration imperfect. Lived eighteen hours. Discusses question of luxation, fracture, and hemorrhage, or laceration of ligaments.

*Post-mortem. Vertebral column:* No fracture; blood extravasation. Posterior ligaments so lacerated as to allow finger to enter the canal. In front the transverse ligaments were torn at the level of the fourth and fifth cervical vertebræ. The body of the fourth was entirely bare. Spinal dura intact. Interlaminal ligaments torn. The muscles were all that held the fourth and fifth cervical vertebræ together. Ligamentum flavam completely torn off. Dura colored with blood; no exudate. Cord removed; hyperæmic; medulla not torn, and in centre blood extravasation, three inches long, on posterior surface, extending through cortex and destroying nerves.

No microscopical examination. Intervertebral cartilages torn in shreds.

This shows conclusively, we think, the possibility of an uncomplicated rupture of the ligaments, and offers a possible explanation

of the pressure symptoms in many of these cases. The hemorrhage here was sufficient to cause death very soon, but had it been of less extent or in some other portion of the cord it is reasonable to suppose it might not have terminated so disastrously. It is, furthermore, not irrational to assume that serous effusions following a forcible flexion of the column might cause temporary pressure and become absorbed and symptoms disappear.

CASE XVII.—Case reported in a French journal, with the following history:

An elderly shoemaker was sitting at his table using a drawshave on a piece of wood, one end of which rested against his chest; this slipped, causing him to fall suddenly forward. As a result there was a slight deformity in the mid-dorsal region; no paralysis; great pain and weakness in the back. He was treated by being placed on his back in bed, with a pillow so situated as to arch his back up directly beneath the deformity. By keeping in this position for seven weeks he was able to get up and about at his work again.

CASE XVIII.—Wagner and Stolper report rupture of ligaments of odontoid and lateral ligaments between the atlas and axis; luxation, with compression of cord, but no fracture or crushing of the cord. Recovery. Lived a year, and died of cerebral tumor.

This case illustrates again the possibility of compression of the cord after rupture, with luxation, and is cited simply because an autopsy was performed, which showed the rupture of the ligaments, the luxation having been reduced at the time of the accident. This is not an uncommon result, of course, and plenty of cases of the sort could be cited from the literature of spinal luxations, but not many with autopsy so long after the injury, where the rupture of the ligaments was carefully noted.

An analysis of these cases from the pathological point of view, where this has been possible, and from the clinical and anatomical point of view in other cases, would seem to justify the following conclusions:

1. Spinal ligaments, during life, may be ruptured without fracture or dislocation.

2. Nerve pressure symptoms may occur from a simple flexion of the vertebral column.

3. Recovery in these cases requires prolonged rest in a position which favors the repair of ligaments, and that the effects of treatment speak more for the ligamentous rupture than for luxation or fracture.

4. The force which commonly produced the injuries (when stated) was one which, *a priori*, would be most likely to cause ligamentous rupture.

The cases which may prove the first point are Nos. I., II., V., VII., IX., X., XIII., XIV., XV., XVI., and VIII.—in all, eleven cases. In one of these cases we have the photograph of a very careful dissection made post-mortem. In another, rupture of a ligament was shown post-mortem, and this occurred from muscular exertion wholly. Further discussion is not necessary in regard to this point, as such facts conclusively show that it is possible to have such an injury.

In support of the second point we can only say that in the three cases of our own, here reported, the production of deformity (flexion of the column) would bring on pressure symptoms which could be immediately relieved by hyperextension, and there was no apparent lateral deviation of the spinous processes, and nothing to suggest that there was any forward displacement of the individual vertebræ at the seat of the kyphos, the hyperflexion of the cord permitted by the ruptured ligaments giving rise to the symptoms. There was no suggestion of thickening from callus in any of these cases. Of course, it must be admitted that every luxation must be accompanied by a rupture of the ligaments, and that it is possible for forward flexion in these cases to have caused a slipping out of the vertebræ, which would then exert the pressure necessary in the production of numbness and weakness. One would hardly expect this, however, without some other external evidence.

In regard to the third point, it is to be noted that in the case where a period of some months has been devoted to fixation of the spine, fresh ruptures are likely to occur, bringing back the old symptoms. Were these cases of ununited fracture of the

vertebræ they would naturally be fractures of the spinous processes of the laminæ, and usually some evidences of bony consolidation ought to be found. That did not occur, or at least was not noted, in any of these cases. Furthermore, in the three cases which we report from our own observation the patients had been in more favorable conditions for union of a bony rupture before the spinal lesion was noted than they were allowed to be in afterward.

And, lastly, in regard to the manner of production of the injuries, there seems to be a rather striking uniformity in the way these patients sustained their ruptures. Cases III., V., VI., VIII, IX., X., XII., XIII., XV., XVI., XVII. are the only ones, except Case XIV., in which the nature of the injury is given. In Case XIV. muscular action alone was responsible for the rupture. In all of the others the force applied was invariably either from above downward upon a flexed vertebral column, or from below upward; and this is precisely the sort of injury one would expect to tear these ligaments. If it is possible, as is shown by Case XIV., to produce within the body, through its own exertions, sufficient force to rupture the spinal ligaments without fracture or luxation, it would certainly seem that the proper combination of external and internal conditions would be forthcoming a sufficient number of times to make this lesion one which is not so very uncommon.

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## DISCUSSION.

Dr. Jos. E. Root, of Hartford, said that he had been very much interested in this paper and in the one read yesterday by Dr. Sayre upon fracture of cervical vertebræ, care, and apparatus for treatment. He would like to inquire of Dr. Sayre whether an attempt had been made to further reduce it. His own observation and experience were that the earlier the reduction was made of a cervical dislocation the better the result. Mention was made of one case of fracture of the cervical vertebræ, caused by a man falling backward from a load of hay, in which he had made an immediate diagnosis, and by manipulation and extension had succeeded in reducing it. Sensation and motion had almost immediately returned. A plaster cast was then placed over the head, shoulders, and waist, extension being produced by means of pads

between cast and top of shoulders, which raised the head. Recovery was complete, with the exception of partial ankylosis, there being about 30 degrees of motion. His stature had been shortened about three-quarters of an inch, showing it to have been an impacted fracture. In a recent case of fracture of the spine in which complete reduction had been made good motion had also been secured.

Dr. Peckham said that he had had a case like this reported by Dr. Painter. A boy had fallen from a tree, and had got up and walked around. A deformity had gradually developed, and he had then come to the hospital. The application of plaster on the Goldthwait frame, without ether, had reduced the deformity, and he was now perfectly well.

Dr. Goldthwait mentioned the case of a child who had come to the hospital, having, a few minutes before, been injured while turning a somersault. The head was turned to one side and could not be moved at all. The boy was seen by different members of the staff, and the diagnosis was partial dislocation of the cervical vertebræ. The child was taken into the hospital for the purpose of having an X-ray made, and the next morning, just before this could be done, a sudden motion of the head restored it to its natural position, and the child was well afterward.

Dr. McKenzie referred to the case of a man, aged about thirty-five years, who while driving in a sleigh in the backwoods of Canada was thrown from the sleigh and fell upon his head. Another man fell upon him, and he was completely paralyzed, but was not unconscious. He remained upon his back for nine weeks, and some time elapsed before there was any movement of the extremities. When seen by the speaker for the first time, some months later, there had been great limitation of motion at all of the joints, especially of the lower extremities. The hands were very livid; all the fingers were ankylosed; rotation was greatly limited at the elbow, but flexion and extension were fair. Under an anæsthetic the adhesions in the joints were found to be very firm and caused a loud noise when broken up. He had asked

himself what was the process by which so many joints had become ankylosed after the fall upon the neck. No fracture had been discovered, and recovery had taken place gradually, though imperfectly. The man could partly close the fingers; the hands were useful, and more than 50 per cent. of the motion at the shoulder joints was present. He metioned the case, thinking it might throw some light on the arthritic disease referred to this morning. It might be a nerve lesion, as had been suggested.

Dr. Sayre said that his patient's head was somewhat restored to the normal position, as far as he thought wise to manipulate it. Later on, by means of monkey-wrenches, the bars running down the neck were bent, and his head was drawn as far back as he could tolerate, so that the position of the head was gradually made straighter. Gradually the motions of rotation, flexion, and lateral flexion, which had been absent, had largely returned.

Dr. Painter said that the class of cases to which he had drawn attention were cases in which the deformity did not develop immediately, and were the result of rupture of the ligaments. As a rule, the injury was made manifest only a considerable time after the patient got up. This class of cases was, therefore, different from those of fracture and luxation.

# THE MECHANICS OF LATERAL CURVATURE AS APPLIED TO THE TREATMENT OF SEVERE CASES.

(Second Paper.)

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The question as to the best treatment of severe scoliosis is one which is far from being settled, and one which has been often discussed in this Association. In recent periodical literature it occupies a prominent place.[1] It is generally accepted that milder cases of lateral curvature (those where the spine is movable) yield, on the whole, to proper gymnastic and mechanical treatment. There is some difference in opinion in such cases as to whether exercises should be directed to the muscles of one side or should be symmetrical, and as to whether or not mechanical support is advisable between exercises. These, however, are relatively minor matters, and do not affect the fact that rational treatment is, on the whole, satisfactory in this class of cases.

On the other hand, it is generally admitted that the treatment of scoliosis, where there is bony rotation and any marked degree of stiffness or limited flexibility of the curved portion of the spine, is, on the whole, unsatisfactory; that a *cure* is not to be obtained by any means now at our disposal; that further progress may be retarded, and that the general balance may be improved.[2]

[1] Schanz: Das Redressement Schwere Skol, Lang. Arch., 61, 4; Ueber den Wirth des Orth. Stutzcorsets. Samml. Kl. Vort., 276. Hüssy: Ueber die Wirk d. Orth. Corsets bei Skol. Z. f. Orth. Chir., 8, 2, 202. Hoffa: Probl. der Sk. Bhdlg. Berl. klin. Woch., 1897, p. 4. Hoffa: Neue Fortschritte in der Sk. Bhdlg. Zeits f. O. Chir., 7, 4. Radicke: Beitr. zur Bhdlg. d Skol. Z. f. O. Chir., 7, 243. Noble Smith: Forced Reduction, etc., British Medical Journal, Jan. 8, 1898. Delore: De la Red. de les Scolioses graves, Jour. de méd. de Paris, 1895, p. 26. Phelps: Transactions of the American Orthopedic Association, xiii. 27. Bradford and Brackett: Correction in L. C., Transactions of the American Orthopedic Association, xii. 28.

[2] A. M. Phelps: Transactions of the American Orthopedic Association, xiii. 297. R. Whitman: Orthopedic Surgery, 1901, p. 143.

There is diversity of opinion as to the most effective method of treatment now in use in this grade of cases, but the trend of recent opinion is toward the use of forcible manipulation to improve the deformity, or of fixed apparatus (generally jackets) temporarily used to retain the improved position. This method is spoken of, perhaps not quite correctly, as "forcible correction," because improvement rather than correction is obtained. The treatment of severe cases by gymnastics alone is unsatisfactory, and treatment by braces alone has fallen into disrepute. Forcible correction is hardly beyond its experimental stage, and there is little agreement as to the method of applying it, its scope, and its efficiency.

That forcible correction holds out the hope of putting the treatment of severe scoliosis in children on a different basis may be inferred from the experiments of Wüllstein, presented at the International Medical Congress in Paris in 1900. He showed that if young dogs were held for some months by plaster bandages in a curved position, during their growing period, a permanent bony deformity of the spine resulted. Conversely, it may be hoped that retaining a growing child with severe scoliosis in an improved position may result in an improvement, and possibly, in time, a cure of the existing bony deformity, where efficient treatment is begun early and persistently followed.

It becomes, therefore, of importance to inquire how the best corrective position may be obtained in such cases of scoliosis, and how forcible jackets may be best applied.

It is the object of this paper to set forth certain observations bearing on the forcible correction of severe scoliosis. These may be classified as follows :

(*a*) The theoretical requirements to be met in forcible correction.

(*b*) The description of a method intended to fulfil some of these requirements.

(*c*) The presentation of cases treated by this method.

(*d*) Experimental forcible correction on the spine of a cadaver.

(*e*) Experiments on a living model with scoliosis.

(*f*) Conclusions from experiments.

(*a*) *Theoretical Requirements.* The present paper is supplementary to the one presented last year before the American

Orthopedic Association, and deals with the mechanics and treatment of the pathological spine in scoliosis, whereas that dealt with the mechanics of the normal spine as applied to scoliosis. The conclusions presented at the end of that paper were as follows :

"Torsion and side flexion of the spine are parts of one compound movement, and neither exists to any extent alone. Lateral deviation of any part of the spinal column is, therefore, necessarily associated with torsion (rotation) at the seat of the deviation.

" In flexed positions of the spine, side bending is associated with torsion of the vertebræ in one direction; in extended positions, by torsion in the opposite direction.[2] In this it follows simply the mechanical law governing flexible rods, which rotate in general in the same way in corresponding positions. From the kind of torsion observed in scoliosis it is obvious that the deformity originates in the flexed position of the spine. The correction of the rotation would, therefore, seem to be logically made by throwing the spine into extended positions and in taking side bendings from extended positions."

If such a theory has any value it must lie in its application to the treatment of scoliosis, and to that point my attention has been directed for the last year.

If scoliosis is acquired in the flexed position of the spine, and if the type of rotation shown in scoliosis is the type characteristic of flexed positions, it would seem to be important to throw the affected portion of the spine into the most extended position possible and to hold it there; because the experiments on the normal spine, just quoted, show that when a person bends to the right, with his spine in a hyperextended position, his vertebræ turn in their rotation to the opposite side from what they do when he bends to the right with his spine in a flexed position; so that one problem of treatment would be to hold the affected portion of the spine in a hyperextended position.

The natural equilibrium of the spine suggests a means of solving

[1] Boston Medical and Surgical Journal, June 14, 1900; TRANSACTIONS OF THE AMERICAN ORTHOPEDIC ASSOCIATION, xiii. 251.

[2] Cf. Lüning and Schulthess. Orth. Chir., Münch., 1901, p. 129.

this problem in dorsal scoliosis. The normal spine when seen from the side presents three curves known as physiological—one long dorsal curve, with the convexity backward, and two short curves, cervical and lumbar, with the convexity forward. To maintain the upright position of the body the centre of gravity must be over the centre of support. If one curve is changed the others must be correspondingly changed also; for, in a general way, they are compensatory to each other in the upright position.

Fig. 1.

Diagram showing equilibrium of the spine, seen from side: *a*. Normal equilibrium. *b*. Lumbar curve flattened where dorsal region is rigid. *c*. Lumbar curve flattened where dorsal region is flexible, showing flattening also of dorsal curve.

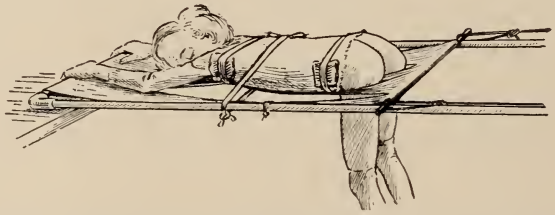
If the lumbar curve is flattened the dorsal curve must be flattened to a corresponding extent. (Fig. 1.) The treatment to be described was based in part upon this fact.

In a case of scoliosis in the dorsal region, for example, if the lumbar curve is flattened, the dorsal curve must also be flattened, if it is flexible. If it is not flexible, and the lumbar curve is flattened, the upper part of the column must be thrown forward and the equilibrium of the whole column disturbed. To induce, therefore, a flattening of the dorsal curve—that is, a more extended

position of the dorsal spine—a flattening of the lumbar spine was attempted. If a scoliotic patient with a flattened lumbar spine stands erect, the influence of equilibrium will tend to produce an extended position of the dorsal spine. To maintain this flattened condition of the lumbar spine the plaster-of-Paris jacket seemed available. One reason for adopting the mode of treatment to be described was, therefore, to hold the corrected spine with the lumbar region flattened.

(*b*) *Method of Applying Corrective Jackets.* For the application of such corrective jackets the easiest way to obtain flattening of the lumbar curve seemed to be to have the patient lie prone on a rectangular gas-pipe frame, on a cloth hammock, with holes cut in the cloth for the legs to hang through perpendicularly. In this way an obliteration, in large part, of the forward lumbar curve was obtained. (Fig. 2.)

FIG. 2.



Patient lying prone on gas-pipe frame. The pads are adjusted to correct a right dorsal curve.

In this position a plaster jacket was applied and was carried to the usual height, and carried as low as possible, the pelvis being firmly grasped. As an accessory to this treatment, side pressure was obtained by bandages passing around the trunk, pulling laterally on the convexities of the lateral curve, these bandages being fastened to the opposite side of the gas-pipe frame.

Jackets were applied with as much or as little force as was desired, with the results as shown in the photographs. It was found in the earlier jackets that it was very easy to obtain an unbearable amount of corrective force without realizing it, and even with padding and all precautions the position which could be easily obtained in some cases was too much corrected to be endurable. Ether was not used in any case.

Jackets were applied at intervals of from five to seven days in all cases where possible, as, from observing the height of patients, and from the statements of the more observing ones, it seemed as if the maximum corrective effect of each jacket was exerted in the first few days after application—after a week it was said to exert less pressure and to feel looser. One reason for the application of jackets in this modified prone position has been already stated, namely, the hope of producing extension of the dorsal spine by holding the lumbar spine in a flattened position.

It seems probable that another element enters in to make forcible correction in the horizontal position more effective than in the suspended position. It was found on several patients that a better correction of the lateral curve could be obtained by corrective side pressure in the prone position than in suspension. The reason for this is probably to be found in the fact that, in suspension, the intervertebral ligaments and some of the muscles connecting the vertebræ are made tense and are on the stretch; whereas in the horizontal position of the body the same structures are lax. It would seem to be natural that these structures, when lax, would allow more side movement between the vertebræ than when tense, for in the latter instance a part of their elasticity would have been already exhausted. A flexible rod with any element of elasticity allows more lateral displacement on side pressure when it is slack than when it is stretched in its length. The simplest manipulation of a rubber tube or a strip of sponge rubber makes this evident.

My object, then, in applying jackets in this way was to induce an extension of the dorsal spine in connection with some side correction obtained during the application of the jacket, and the patient was placed in the prone position in order to secure the greatest side correction possible. By this treatment I hoped to stretch contracted ligaments and muscles; to make the patient, by his sense of balance when erect, continually strive for a better position, and to push the curved portion of the spine nearer the median line. I did not expect appreciably to change existing bony curves in adolescents or adults, but to place them in a better relation to the rest of the spine, and perhaps to improve the curves themselves a very little. In young children, on the ground of Wüll-

stein's experiments, I hoped, by a maintenance of corrected position, either by jackets or by other means, to induce, in time, an improvement of the bony curve. Jackets including the shoulders were not applied, although they would be obviously desirable in many cases.

The present method is crude and incomplete as here described, but the lines in which its better development will probably take place will be indicated.

Non-removable jackets were regarded only as a temporary expedient to secure a better basis for further treatment.

(*c*) *Presentation of Cases.* The method pursued in the cases observed was as follows: Two cases—one a severe paralytic case, in a girl aged eleven years, and one an extreme bony curve, in a girl aged fourteen years—have worn continuously jackets applied at varying intervals.

In the others, after two, three, or more corrective jackets had been applied at short intervals, a removable leather or celluloid corset was made, and exercises were at once begun, and the jacket worn between exercises. As observed so far the improvement has been held during the months since the application of the jackets.

In one case, where much correction had been obtained by two or three jackets, proper treatment was discontinued at once, and in three months the boy had slipped back to his former condition.

It is the intention, except in paralytic cases, to discontinue the use of support after a few months at most, continuing gymnastics, of course, for a much longer period.

The cases reported here are not selected in any way, but are those cases, from a group of twelve or more, of which I have the most satisfactory photographs.

Patients were photographed sometimes by me and sometimes by someone else. The endeavor was to give a fair photograph without suggesting to the patient to stand in a voluntarily improved position. The photographs in general are not as good as they should be, but, even as they are, they are better than unsupported statements as to the results obtained.

Case I.—K. C., aged eight years. Severe paralytic case of five or six years' duration; rigid curve; paralysis also of right

leg, with one and one-half inches of shortening; rotation very marked; no previous treatment beyond an occasional plaster jacket. Series of plaster jackets at intervals of one, two, or three weeks from October, 1900, to June, 1901. No attempt made as yet at gymnastic treatment, on account of paralysis of

FIG. 3.

Case I. K. C. October, 1900.

FIG. 4.

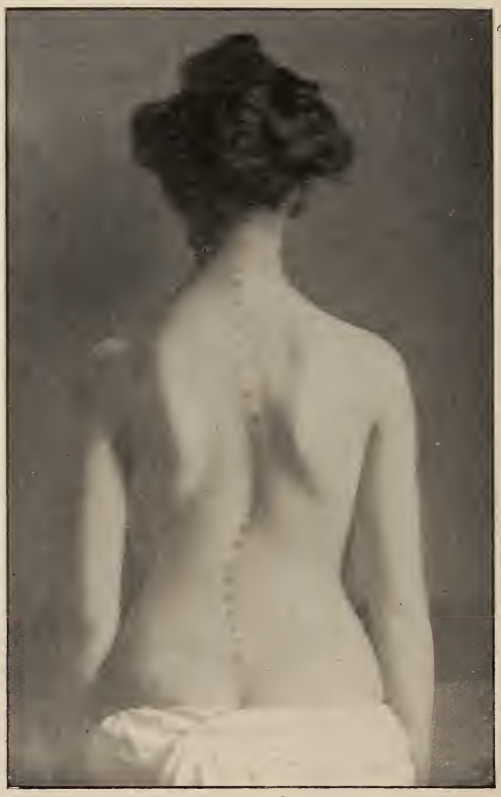
Case I. K. C. June, 1901.

muscles of back. Bony rotation, so far as shown by photographs, has not been diminished. (Figs. 3 and 4.)

CASE II.—S. A., aged fifteen years, previously untreated. Rigid bony curves, with marked bony rotation of several years' duration. Three jackets were applied at intervals of one week;

a removable leather jacket was then applied, and the patient went to her home at a distance. Exercises were prescribed, which she did herself without assistance. An interval of three months elapsed between the third and fourth photographs. (Figs. 5, 6, 7, and 8.)

FIG. 5.



Case II. S. A. February 2, 1901. Before the application of jacket.

CASE III.—Mary M., aged fourteen years. Rigid curve in left lumbar and dorsal regions, with bony rotation very marked. Treatment for a short time some years previously by suspension jackets. Treatment for one year by prone corrective jackets applied mostly at short intervals. (Figs. 9 and 10.)

Case IV.—E. B., aged eleven years. Rigid curve, with bony rotation. Some previous treatment by gymnastics. Position cannot be voluntarily corrected. Between the first and last photographs four corrective jackets were applied, covering a period of

Fig. 6.

Case II. S. A. February 16, 1901. After two corrective jackets.

five weeks. Treatment since the last photograph consists of a removable jacket and exercises. (Figs. 11 and 12.)

It is well known that most postural cases and cases of scoliosis without fixed curves, as a rule, yield readily to proper treatment, and cases of that type, if cured or improved by any different treat-

ment from those in common use, would show very little that was convincing.

To avoid the criticism that consequently would follow the treatment of mild cases by this or any method, only severe cases of fixed curves were taken for observation, and forcible jackets

FIG. 7.

Case II. S. A. February 23, 1901. After three corrective jackets.

alone are here discussed. Consequently, only severe cases with fixed curves and bony rotation have been presented here.

(*d*) *Observations on Cadaver.* Before drawing any conclusions from the cases presented it may be permissible to add certain observations made on the scoliotic spine of a cadaver, and certain

minor observations made on the living model, as both have some bearing upon the question as to the best means of obtaining forcible correction of the spine.

By the courtesy of Prof. Thomas Dwight the following observations were made upon the scoliotic spine of a cadaver from the

FIG. 8.

Case II. S. A. May, 1901. After three months of gymnastic work at home.

dissecting-room of the Harvard Medical School. The spine was from a man about forty years of age The cadaver had been prepared in the usual way for dissection, and the sternum and some of the anterior ends of the ribs had been removed to facilitate injection; otherwise the spine was intact and was well preserved.

The outer muscles had been, for the most part, cut away during the routine dissection, and the viscera had been taken out. The remaining muscular masses were removed, but no elaborate dissection was undertaken for fear of disturbing the ligaments.

Fig. 9.

Case III. Mary M. July, 1900.

The scoliosis was apparently of static origin and of many years' duration. At the sides of the bodies, along the concave side of the lateral curve of the spine, were found small projecting ridges of bone running from the edges of the vertebral bodies. There was no evidence of disease of the spine, and, except for the affected part, the spine was as movable as the average normal spine of the

dissecting-room subject. The scoliosis was to the right in the dorsal region, with slight compensatory curves to the left in the cervical and lumbar regions. The greatest side deviation, as seen from the back, was reached at the sixth or seventh dorsal vertebra.

FIG. 10.

Case III. Mary M. July, 1901.

Bony rotation was marked, the right side of the chest being carried well backward.

Observations were made which consisted largely of manipulations of the spine similar to those used in the treatment of scoliosis, and the effect of each manipulation was noted as accurately as possible.

The conclusions of the experiments only are given here.

*Suspension.* Experiments were first undertaken as to the corrective effects of strong traction made in the length of the vertebral column. The spine was hung by the atlas from an overhead pulley, and the sacrum was fastened in a vise attached to a table

Fig. 11.

Case IV. E. B. July 23, 1901. Natural standing position before application of jacket.

weighing about twenty-five pounds. Enough force was used to lift one end of the table from the floor. This amount of traction was sufficient to lengthen the spine one inch, but this lengthening was apparently due rather to the straightening of the cervical and lumbar physiological curves than, as will be seen, to any change

in the fixed dorsal curve itself. After suspension it took the spine several minutes to settle to the length that it had before traction was made.

The lengthening of one inch is not so important a change as it might appear, nor does it necessarily imply any distraction of the

FIG. 12.

Case IV. E. B. August 27, 1901. Natural standing position after the application of four corrective jackets.

vertebræ, although such, perhaps, occurred. The same spine showed a difference of four and a half inches in length between the flexed and hyperextended positions when measurement was made along the spinous processes. Slight changes in the physio-

logical curves were sufficient to make marked variation in the measurements of the length of the spine when traction was not being used.

Experiments were then made as to the amount of side correction to be obtained in the curved part of the spine by the amount of suspension force described above.

FIG. 13.

Scoliotic cadaver, back.

Hat-pins were driven into the spinous processes of vertebræ, at the top and bottom of the curved region. These pins were connected by a thread, and the side deviation of a pin in the spinous process of the sixth dorsal vertebra was studied from this thread.

The greatest side displacement of the pin that could be observed, when traction was made in the length of the spine, was one-eighth of an inch; that is, the sixth dorsal vertebra was one-eighth of an inch nearer the median plane in the suspended than in the unsupported position of the spine. In this spine, therefore, the corrective effect of traction in regard to the lateral curve was very slight.

FIG. 14.

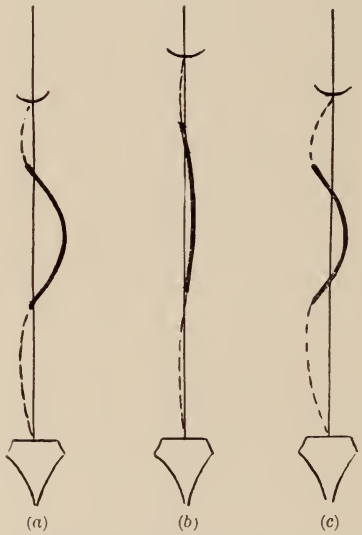
Scoliotic cadaver, front.

*Flexed and Extended Positions.* It was not possible to determine that either the flexed or hyperextended position of the spine influenced the lateral curve markedly, as the sources of error were too many to make this observation of value.

*Side Pressure.* Corrective side pressure was then made upon the convex side of the ribs by the hand. It was more effective; that is, the same pressure seemed to accomplish more lateral correction in the prone than in the suspended position.

The greatest side correction that could be produced in the curve itself was one-eighth of an inch, when the relation of the sixth dorsal vertebra to a line connecting the upper and lower dorsal vertebræ was considered; that is, a change of one-eighth of an inch could be made in the dorsal curve itself. But when the

FIG. 15.




(*a*) Diagram of spine, seen from back, with right dorsal left lumbar curve. (*b*) Same spine, with curve corrected partially. (*c*) Same spine with curved region pushed bodily to the left, with curve unchanged.

side movement of the same vertebra, under the same manual pressure, was considered in its relation to a line connecting the atlas and the sacrum, one-half inch of side correction could be obtained; that is, it was easier to displace the whole curved region to the other side than to make the curved region itself straighten. That is, there was in the spine a fixed region, bounded above and below by the most movable parts of the spine, the lower cervical and the lower dorsal region. Manipulations to correct either the rotation or the lateral curve were, therefore, more

likely to take effect above and below the curve than in the curve itself. Side pressure pushed the whole dorsal region to the left, but made little impression on the curve itself. (Fig. 15.)

This contrast between the fixed and movable portions was notably to be seen in attempts to correct the rotation. If oblique forward pressure were made upon the angles of the ribs, as prominent on the right side of the back, the cage of the thorax revolved horizontally, in one piece, upon the two movable parts above and below it, and the lateral curve, as seen from the back, was increased. This was because the curved part of the spine, convex to the right, was twisted and carried further to the right, and the convexity of the lateral curve was apparently increased by being carried into another plane. Moreover, by this passive rotation of the thorax, the right side being twisted forward and the left back, the curved dorsal region was placed in a less favorable relation to the cervical and lumbar compensatory curves, thus making the whole lateral curve appear more marked, as seen from the back.

The reverse of this manipulation (that is, backward side pressure upon the right side of the chest) increased the rotation, but diminished the lateral deviation of the spinous processes and made the spine straighter when viewed from the back, because the thorax again moved as a whole, the curved line of spinous processes was brought into a more favorable plane and into a better relation with the cervical and lumbar regions.

So far as the lateral curve was concerned, the best position of all was when both pathological rotations, dorsal and cervical, were forcibly increased by manual twisting; that is, if the right side of the chest were rotated backward and the left side of the cervical region were rotated backward, the best obtainable position of the spine was secured, so far as the lateral curve of the spinous processes was concerned.

Apparently the same is true of the bodies of the vertebræ.

To meet the criticism that, in the cadaver on which these experiments were made, the sternum had been removed, it may be said the presence of the sternum would contribute still more to the rigidity of the thorax and would make the application of twisting force to the thorax still more effective in the direction indicated.

In fixed curves, therefore, diminishing the rotation by manual manipulation increased the lateral deviation, and increasing the rotation diminished the lateral deviation. The importance of this in its relation to therapeutic measures may be easily appreciated. For this reason, therefore, forward or forward oblique pressure

FIG. 16.

Model twisting to the left, showing the consequent lateral deviation of the spine.

upon the right side of the back (in this case of right dorsal, left lumbar curve) made the lateral curve worse.

There seems to be, in addition to this, a second reason connected with the intrinsic mechanism of the spine, which acted at the same time to make this manipulation increase the lateral curve.

Every rotation in the spine not organically diseased is accompanied by a lateral deviation of the spine when viewed from behind. This may be seen as well in the backbone of a fish or a cat as in the human model, being merely one mechanical attribute of a flexible rod. The human model, twisting with the right shoulder forward and the left back, shows a marked lateral deviation to the right in the dorsal region and to the left in the lumbar region.

The twisting forward of the right side of the thorax in the cadaver worked, therefore, to cause a right dorsal, left lumbar curve of itself, as occurs in any flexible rod or any spine twisted in the same direction. This, in the cadaver in question, served to exaggerate the existing curves. Thus these two factors—the rigidity of the thorax and the natural mechanical laws of the spine—worked together to cause an increase of a right dorsal, left lumbar curve, when the right side of the chest was actively or passively rotated forward.

In short, diminishing the rotation increased the lateral deviation.

(*e*) *Experiments on the Living Model.* A similar experiment was made upon an adult woman patient with a severe fixed curve similar to that of the cadaver.

It will be seen that when the bony rotation was diminished by forward pressure on the angles of the ribs on the right side the lateral deviation was increased, no side pressure being made. When the rotation was increased by backward twisting of the right side, on the other hand, the lateral deviation was diminished.

(*f*) *Conclusions from Experiments.* From these experiments on the cadaver and model it is evident that forcible attempts to correct bony rotation must be made with much care, remembering that it is easier to twist the whole thorax unchanged than to effect any considerable change in the curve itself.

This has been recognized in the construction of some of the instruments for forcibly correcting the spine.[1] Much apparatus has aimed only at oblique forward pressure on the bony rotation; for example, the "detorsions apparat" of Schulthess.[2] This sort

[1] Bradford and Brackett. Children's Hospital Report, Boston, 1895, p. 234. Hoffa: Orth. Chir., second edition, pp. 421, 422.

[2] Lüning and Schulthess. Orth. Chir., München, 1901, p. 286, Fig. 159.

of pressure, while it may diminish the rotation, so far as it is effective, will increase the lateral curve.

This criticism applies not only to the use of much corrective apparatus, but also to gymnastic work where attempts to correct the rotation in fixed curves is made by manual pressure upon the

FIG. 17.

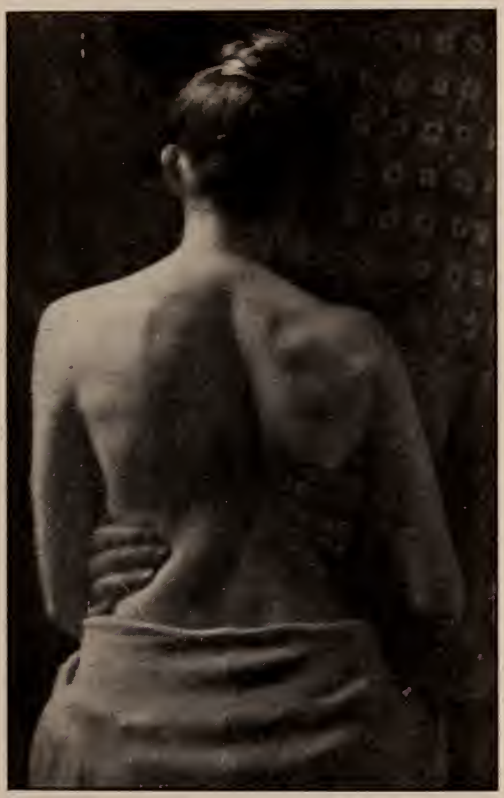
Patient sitting in natural position.

prominent ribs. Figs. 18 and 19 are a sufficient comment on this class of work.

In so far as the corrective force used presses forward upon the rotated ribs, it must be met by counterpoints of force on the thorax, preventing the rotation of the thorax as a whole; other-

wise the force will be dissipated through the spine, and the thorax will be twisted unchanged. If it is met by such counterpoints of pressure, the force will be expended on the thorax, and will be corrective so far as it is effective.

FIG. 18.



Rotation diminished by forward pressure on the right side of thorax. No lateral pressure is being made.

Forcible correction by pure side pressure may increase the rotation, but, so far as it is effective, will diminish the lateral deviation. That this is not new may be appreciated by a quotation from Schreger[1] in 1810: "*Der seitliche Druck auf die Rippen*

[1] Fischer, quoted by Hüssy.

*biege diese an den ohnehin schon mehr Spitzen Winkeln noch mehr Spitzig zu.*"

That plaster jackets may cause increase of the rib angle is demonstrated by Hüssy.[1] The same point, that plaster jackets

Fig. 19.

Rotation increased by forward pressure on the left side of chest. No lateral pressure.

may increase the bony rotation apparent in the back, has been alluded to by Schulthess and Vulpius.[2]

It may, therefore, be stated that attempts, in fixed curves, to diminish the rotation by force in any degree directed forward,

[1] Hüssy. Zeitsch. f. Orth. Chir., viii., 2, 235.
[2] Vulpius. Volkmann's Samml., kl. Vort., 276.

not carefully antagonized on the thorax, will lead to an increase of the lateral curve. Conversely, attempts to diminish the lateral curve by pure lateral pressure, not carefully antagonized, will result in fixed curves in an increase of rotation, as it is easier for the whole thorax to rotate backward than to give way laterally.

If forcible correction is to be used properly, both forward and lateral force must be met by opposing forces on the thorax itself; the force must be expended on the curve and limited to the thorax. The only way to do this, obviously, is to keep the thorax from rotating on the movable points of the spine, and to exert the pressure there instead of distributing it through the spine.

In flexible cases, on the other hand, the reverse seems to be true, that rotation and lateral deviation are parts of one movement and are correlated. That class of cases, however, is not discussed in the present paper. Given, however, a fixed condition of a distorted spine, and the conditions are changed.

An active or passive rotation of the spine in one direction causes a right dorsal, left lumbar curve, and, in the opposite direction, a left dorsal, right lumbar curve. This suggests that one or the other of these rotations might be used with benefit in a given case, in addition to direct lateral or oblique pressure, in the application of corrective jackets to secure improved position of the lateral curve. The same is equally true of their probable usefulness in gymnastic work. The chief work on the use of rotations in their corrective effect on scoliosis has been contributed by Wüllstein.

It seems not unlikely that the understanding and use of rotation of the spine as a corrective measure in scoliosis may be the next step in progress.

Conclusions. In cases of scoliosis with fixed bony curves the same theory of corrective treatment cannot be applied as in cases of scoliosis with flexible curves. The fact that there is a fixed portion of the spine situated between two movable parts makes it easier to twist or displace the thorax as a whole than to make any change in the curved portion itself. As a result of this, forcible attempts to correct bony rotation in fixed curves will increase the lateral curve unless the thorax is kept from rotating, and forcible attempts to correct the lateral curve are likely to increase the rotation.

To judge from the observations on the cadaver, suspension as a corrective agent has but little corrective effects in rigid cases, being more likely to affect the compensatory curves than to produce any marked improvement in the rigid curve itself.

For the application of forcible jackets, the prone position, with the legs hanging perpendicularly, seems the most effective, for two reasons: First, because in the prone position greater side displacement between the vertebræ is permitted on manipulation than in the suspended position, because in the former the spine is not put on the stretch and part of its elasticity thereby exhausted; and, second, because in the prone position, with the legs hanging perpendicularly, it is possible to apply a jacket which shall flatten, in some degree, the lumbar curve of the spine, and when the erect position is assumed this flattening of the lumbar spine will necessitate some degree of hyperextension in the dorsal region on account of the equilibrium of the spine.

When the effect of rotations of the spine, in their effect on lateral deviation, is better understood it will probably be possible to add the element of rotation to the corrective force applied in the treatment of scoliosis.

With regard to forcible correction, one of two things may be done: (1) Force, carefully antagonized, may be applied to the curve itself, with a view to improving the curved portion of the spine; (2) the curved region may be twisted as a whole, or displaced sideways as a whole in its relation to the rest of the spine, as occurs when unopposed force is applied to the curve. The former is, of course, the more desirable when it is possible, but the latter may be of much use in improving the general outline of the body. The separation of the two is important for the application of intelligent therapeutic measures. It is relatively easy to displace the thorax in relation to the rest of the column, but relatively hard to change the curve itself.

Forcible correction seems to have its place only as preliminary to gymnastic treatment, and the writer would not wish to be understood to advocate the use of corrective plaster jackets except as a temporary means to secure a better foundation for better gymnastic or, if necessary, mechanical treatment.

## DISCUSSION.

Dr. Phelps said he was sure all present felt indebted to Dr. Lovett for his accurate and scientific paper. For years he had believed that any line of work on these curves exerted absolutely no effect upon them, and that the cure consisted in obtaining compensatory curves. He had also believed that when force was applied to the spine the whole deformity was pushed over *en masse*. The question of rotation in the direction of the curve had been taught, and it had been generally believed. In 1897 he had asked Dr. Judson to examine a case in which he had discovered a curve in one direction and a rotation in an opposite direction. Dr. Judson's explanation at that time was incorrect, in view of what had just been presented. The speaker said that he had made the statement that we knew very little about this subject, and his anatomical specimens showed that if one ever expected to increase the compensatory curves the entire thorax must be changed. The muscles of the back over the curve were atrophied and destroyed, as they were also on the side of the concavity on account of long disuse. He believed Dr. Lovett had opened up this interesting problem along the proper lines, and he looked forward to some results directed along the lines laid down in this paper, making compensatory curves both above and below the primary curves.

Dr. Peckham said that he had been working in this field also, and had placed the patient from the very beginning face down. He did not allow the legs to hang, but stretched out upon the hammock. So far he had only been able to secure a rearrangement of the curves, which improves the carriage and the appearance of the patient when standing.

Dr. Whitman said that as the reader of the paper stated that he had not had sufficient experience with the plaster jacket method to justify him in drawing any conclusions, he would cite a case in which there was an extreme congenital rotary lateral curvature, accompanied by congenital hernia and also by short leg and

equinus. This patient had been under observation for nearly six years. For this time corrective plaster jackets had been employed. At the present time the deformity was almost entirely corrected—*i. e.*, rotation as well as lateral deviation. He was unable to see the applicability of Dr. Phelps' arguments drawn from adult patients, because as orthopedic surgeons they were particularly interested in the early cases, especially those occurring in young children, not in the extreme and irremediable cases exemplified by the specimen described by Dr. Phelps. He was positive many of this milder type could be cured. He had noticed that children who were treated in groups by means of exercises were all treated in about the same way, and it had occurred to him that this might be wrong. If one found, for example, a flat spine in a certain case, the inference was that the primary curvature was in the lumbar region, and was accompanied by rotation; if, on the other hand, that spine showed marked kyphosis in the dorsal region and marked lordosis in the lumbar region, the inference was that the rotation and the primary curvature were in the dorsal region. It would seem thus that a distinction should be made in treatment according as the deformity of a part of the spine were primary or secondary.

Dr. Compton Reily, of Baltimore, said that in almost all of the appliances for correcting lateral curvature only three or four points had been made use of, and it had occurred to him that the same method might be made use of which is sometimes employed by boys in breaking a stick in two pieces by seizing it at both ends.

Dr. Freiberg said that after considerable effort to make measurements of scoliosis more precise there seemed to be still much room for improvement in this direction. At one time he had worked with the Zander instrument, but recently had been depending upon the photographic process chiefly for recording cases of scoliosis; yet he was convinced that none of them was at all satisfactory. During the past winter he had taken several cases of scoliosis that had been under treatment, and, without saying anything to them as to the reason why, he had photographed them repeatedly, sometimes almost daily for a considerable period. The

photographs had all been taken very rapidly by very short exposures, yet he had been surprised at the great variations exhibited by these photographs. The variations were greatest, of course, in the cases in which there was the greatest amount of mobility of the spine. This seemed to him one reason why scoliosis could not be accurately measured by any known method. Another reason was that we depend chiefly for the measure of the lateral deviation at least upon the position of the spinous processes. Very little study must show that the relative position of the spinous process and body was not uniform in scoliosis. The amount of lateral distortion and rotation does not always cause the same amount of change in the spinous processes; hence it was erroneous to take the spinous processes as an absolute measurement of the degree of rotation or lateral deviation.

Dr. Weigel asked Dr. Lovett whether in this apparatus for measuring scoliosis two persons with the same apparatus and the same patient could get practically the same result. That had not been possible in any form of apparatus heretofore devised. Two years ago he had seen Schulthess himself measure cases with his own expensive apparatus, and yet he admitted that he allowed no one but himself to make these measurements. Dr. Weigel said he had devised an apparatus for obtaining a tracing of the curve of rotation; and while it was fairly satisfactory, he did not think the same results could be secured by any two persons on the same subject. Absolute and accurate measurements were, of course, not essential in any one particular case, but they were most useful for purposes of comparison. He was surprised to hear Dr. Lovett make the statement that in the experiment on the cadaver he did not consider the removal of the sternum and ribs of much moment, for certainly these bones should influence the problem considerably. He would like Dr. Lovett to state whether, in his opinion, suspension having been shown not to produce any change in the essential curve, a corrective apparatus applied in the upright posture, without suspension, would not be preferable.

Dr. Ridlon called attention to the observations of Mr. William Adams, of London, who, in 1852, removed post-mortem the spine

of Dr. Mantell, and demonstrated that the line of the spinous processes was straight, while the curvature in the bodies of the vertebræ was very great.

Dr. Phelps contended that Mr. Adams concluded that in that particular case the greater the rotation the less the curvature, but that he did not state this as a general rule.

Dr. Ridlon replied that as the bodies rotate the line of the spinous processes becomes straighter, providing the spine as a whole does not become more curved. The anterior portion of the spine radiates, and as this goes on it diminishes the curvature of the posterior portion.

Dr. Lovett, in closing the discussion, said that he had hoped his work might be encouraging rather than discouraging. In the older cases, in which the bones are fixed, one would be unreasonable to expect any great change, the problem being merely to correct the posture above and below as far as possible. His own feeling was that every case was a separate and individual anatomical problem, to be worked out by itself. He had had no experience with class work, each case being treated by itself. He wished to enter a plea for the more exact study of each case and in the application of forcible correction and the use of jackets. He considered this most important. As to Dr. Weigel's question, he would say that he could see the cases change while they stood before him. He could get two measurements within two minutes with the apparatus shown by him, and he thought that measurements taken on succeeding days under the same conditions should be alike, but he could not say so positively. He did not particularly care to encounter the criticism that must antagonize any apparatus for the recording of lateral curvature, as to his mind it must be essentially a variable quantity. The spinous processes could not be accurately marked, and the sources of error were so great that scientific exactitude seemed to be out of the question in any apparatus. He had found satisfaction, at the given time, in putting down about the state of the curve, and he found much more benefit from the apparatus in studying the curve and knowing its

characteristics than from any attempt to secure an exact record. With regard to the absence of the sternum in the cadaver, he would say that any continuity in the ribs would have simply resulted in making the pressure more effective. He did not mean to say that the removal of the sternum made no difference, but simply that it did not alter the essentials of the problem, or, if it did so, it would be against his conclusions. The problem in this case was to deal with a rigid portion, and the ribs were firmly enough attached to the vertebræ and to each other to make the sternum only an accessory.

# CONGENITAL DEFECT OF FOREARM, ABSENCE OF RADIUS, CLUB-HAND, ETC. PLASTIC OPERATION.

By ROSWELL PARK, M.D.,
BUFFALO, N. Y.

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The patient, a little girl, aged four years, from Saginaw, Mich., was brought to me in the summer of 1900 with a condition which is, perhaps, better portrayed by the accompanying illustration than by any description that I can write. Suffice it to say that there appeared to be a complete absence of the left radius, which appearance was corroborated by the skiagraph, while the ulna was shortened and curved, with the hand set at nearly right angles to the forearm, the hand turning almost at a right angle to the radial border. There was defect also in the bones of the hand proper, especially in the absence of the metacarpal bone of the thumb, whose two phalanges could be pushed up and down on the side of the hand. Control of the fingers was quite uncertain, and the phalangeal joints of the third and fourth fingers were stiffened with the fingers in the flexed position. The ulna was one and one-half inches shorter than that of the other arm. The child was otherwise in perfect health. There was no history attaching to the mother's pregnancy or to other congenital troubles in the family.

The question naturally was as to what could be done in the way of remedying the defect and producing a better cosmetic result. The prospect of transplanting the radius did not seem encouraging enough to warrant the attempt. I did think best, however, to attempt transplantation of bone for absence of the first metacarpal bone. It seemed to me that the most hopeful thing that I could do would be to straighten the forearm by

bending the ulna and then to impale the carpus upon the sharpened end of this bone, maintaining the hand in the proper position, and hoping for a sufficient union between the ulna and carpus to make the hand useful and straight.

Operation was done September 1, 1900, at the Buffalo General Hospital. The tendons on the radial side of the forearm were so much shortened that my first plan to merely expose the end of

the ulna, shorten and sharpen it, could not be carried out. I therefore exposed the carpus, which apparently was also defective in its arrangement, and removed parts of two bones of the first row; then freshening, and, at the same time, sharpening the end of the ulna after the fashion of a picket, I tried to fasten it into the carpus, but had to keep it from sliding by passing a needle with kangaroo-tendon suture through the bones, thus lashing them together. I also made an incision over the location of the

first metacarpal bone, and transplanted thereon a piece of bone about one inch long and one-eighth inch in diameter, taken from the humerus of a still live rabbit anæsthetized for the purpose. Both of these wounds were closed without drainage, and the arm dressed upon a splint in a perfectly straight extended position. At the end of ten days the dressings were changed, the wounds found to be perfectly healed, and the splint was then shortened up so as to encourage motion in the fingers. This was the more necessary, because the stiffened phalangeal joints had also been loosened under the anæsthetic, and I wished to get restoration of motion here, if possible.

The subsequent course of the case has been uneventful; the child lives at such distance from me that I have not since seen it, but the accounts of the case sent by the family are exceedingly encouraging. It was necessary to fit a very light moulded splint upon the arm, in order to maintain it in the position in which it should grow and develop. The child wears this splint at night and part of the daytime, is getting very good use of the hand, and appears, so far as they can tell me, to have developed some new bone at the point where the rabbit bone was transplanted.

[Sept. 1, 1901. The transplanted bone has disappeared by absorption ; otherwise the result is good.]

# A CASE OF EXTREME TORTICOLLIS TREATED BY REPEATED RADICAL OPERATION, WITH OPEN DIVISION OF ALL RESISTING STRUCTURES.

By ROSWELL PARK, M.D.,
BUFFALO, N. Y.

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Mrs. G., aged twenty-nine years, wife of a physician of Chautauqua County, New York, was referred to me by Dr. J. W. Putnam, of this city, with whom I was associated in the management and especially the operative treatment of the case. Her history is as follows: Her grandmother had migraine; her mother was subject to rheumatism, and died twenty-three years ago of "cerebral meningitis following rheumatism." Father is living; is also a sufferer from migraine. Was healthy during childhood; has suffered repeatedly from rheumatic attacks. A few years ago had a severe attack of grip, with great depression, especially mental, which lasted for several months. During this time there was some pelvic trouble, which, together with the melancholia, disappeared, and for two years subsequent she seemed quite well.

The present condition began in January, 1900, at which time there was jerking of the head toward the left shoulder and muscle spasms involving the arms and upper part of the body to such an extent that it became almost impossible for her to take food. The trouble was adjudged to be choreic in nature, and she was given Fowler's solution in increasing doses until three months later, when it had to be stopped because her stomach would not tolerate it. In May arsenic was given again in the form of bromide. The latter part of May the hypodermic use of the drug was begun; then she was given doses increasing in size up to 35 drops. On

the afternoon of May 27th the choreiform jerking had stopped entirely, and her head could be held for a short time in normal position. This lasted for only a few hours. Large doses of arsenic were given hypodermically up to July 11th, by which time the spasmodic action almost entirely stopped, but the head remained in a cramped, rigidly contracted position, with the chin almost in contact with the left shoulder. The hypodermic injec-

tions were nearly all given in the right thigh, and led to numerous abscesses. She was confined to bed until September. During a part of this time, and later, she required considerable morphine because of her physical distress, and the morphine habit entered not a little into and complicated the case.

When seen by me with Dr. Putnam the condition was one of extreme wry-neck, the chin being drawn over nearly to the left

shoulder and almost in contact with it; maintained almost constantly in that position, with frequent spasms of all the associated muscles. The right sternomastoid muscle was very tightly contracted and, at the same time, very much increased in volume—*i. e.*, hypertrophied by overuse. The border of the right trapezius seemed also involved, as well as the left trapezius; but her head was drawn so completely over to the left side, and the neck so curved, that it was almost impossible to make out the condition of the cervical muscles on that side. In endeavoring to ascertain the cause of the original trouble, Dr. Putnam and I both agreed that it must be due to a neuritis from excessive use of arsenic.

The first operation was performed March 19, 1901, at the Buffalo General Hospital. I made a long incision over the posterior border of the right sternomastoid, exposing this very much enlarged muscle, which was unusually adherent within its sheath. It was dissected completely loose, the upper end divided about one and a half inches from the mastoid, the lower end about two inches above the clavicle, and the intervening portion was entirely removed, including the spinal accessory nerve. I then extended the upper border of the incision backward and exposed the border of the trapezius. I did not attempt to dissect this loose from its attachment to the skull, but divided and took out a V-shaped portion of the muscle extending back almost to the middle line, the upper border of the defect being at a distance of one inch from the occipital bone. After doing this work upon the right side, and endeavoring to restore the head to its position, it seemed that there was powerful opposition from the left trapezius. Accordingly I made an oblique incision on the left side corresponding to one of the folds of the skin, and through it exposed the border of the left trapezius. Here I did not excise any portion, but divided it freely back almost to the middle line. It then became evident that the levator anguli scapulæ on this side was also contracted. Accordingly it was divided through the same incision, but the space was so restricted—it being still hard to hold her head over toward the middle line—that I could not be positive that it was completely divided. After all this work was done the head was maintained in the middle position, under the anæsthetic, with a mild degree of force. The wound on the left

side was packed with bismuth iodide gauze, with the intent that it should heal by granulation. On the right side I drained the posterior part of the wound and closed the incision completely with sutures. The patient stood the operation very well, but on recovering from the anæsthetic it was found that the head was still drawn well over to the left.

The patient made a remarkably rapid recovery from this first operation. On the right side the wound healed by primary union, and on the left side it filled in very rapidly with granulation tissue and was perfectly well within three weeks. While the position of the head was not particularly improved, the immediate result of the operation was cessation of all spasms of the shoulder muscles and relief from consequent discomfort. By the end of the month, however, the head was turned to the left almost as violently as ever, and she began to complain of great pain, and especially of soreness, in the vertebral joints.

On April 17th I operated the second time, confining my attention to the muscles of the left side of the neck. It being very difficult to turn the head sufficiently to the right to make free access to the part, the operation was made throughout its course unusually hard for the operator. I began with an incision along the posterior border of the left sternomastoid, and had finally to lay up a triangular flap whose apex pointed downward. On this side it was found that the sternomastoid was also tense, rigid, short, and thickened. My first step was to remove some two inches of the muscle at its middle portion; then it was found that the cervical portion of the trapezius was also tense and contracted, and accordingly I cut away a large triangular section of this muscle, including most of its supraclavicular and cervical portion. It was now easier to bring the head over to the right side. It was still evident, however, that a strong pull was being exercised by tissues above and parallel to the clavicle. Accordingly the incision was extended still further down the neck, and I came upon a band of thickened muscle and connective tissue whose outlines were blurred, but which after some dissection I made out to be the omohyoid. Why it was in this condition I could not determine, but it constituted a band of tissue firm and dense and as thick as my little finger. A section of this was removed, and

after its removal the head could be easily brought over to the other side of the median line. No important bloodvessels were disturbed or cut through this extensive operation. I tried to identify the cervical nerves, but, in the hypertrophied and adherent tissue, anatomical landmarks were obscured, and I am not sure that I did recognize and divide them. Aside from the cutting, a good deal of stretching of bands of connective tissue and of recent scar-tissue was done, and the operation constituted, in effect, an open division of everything that resisted from one inch above the clavicle nearly up to the occiput. This wound was closed with catgut sutures, one or two small openings being left for drainage, but without drainage-tube. To the posterior aspect of the head and body there was moulded a posterior plaster splint, and in this the head and neck were fixed. Upon the following day the patient expressed herself as relieved of all her old pain, the only complaint made being that of the irksomeness of the splint. This large wound healed as rapidly as did those first made, and in a short time the patient was able to wear a support and brace for the neck devised by Dr. Putnam, in which she soon travelled home. Her head and shoulders are now in very natural position. She has no muscle spasm whatever, no discomfort, and, altogether, the operation seems to have relieved nearly everything of which she complained.

Open division, or even extirpation of the sternomastoid, is well known as a remedy for wry-neck, but never to my knowledge has such an extensive operation as this been practised, nor for so intractable and serious a condition. The case seems to me in many respects similar to those cases of muscular disorders of the eyes where graduated tenotomies have often to be made in successive operations.

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## DISCUSSION.

Dr. W. J. Taylor said that he had had the pleasure of assisting Dr. W. W. Keen in a similar operation some years ago. Both sternomastoid muscles had been removed at different operations, and this had been supplemented by massage for about one year.

In spite of the removal of both sternomastoids the man had had complete control over the movements of his head.

Dr. Weigel said that he had seen a case of severe scoliosis occurring in a child with club-hands and congenital absence of radius and thumb. The child had been able to carry out all the exercises with the club-hands. He thought if such hands were straightened out very much of their usefulness would be destroyed. The angle at the junction of the hand with the forearm is convenient for many purposes, and largely compensates for the absence of the thumbs. Of course, when a well-developed thumb exists the proposition is an entirely different one.

Dr. McCurdy said that in the Transactions of 1893 would be found the report of a case upon which he had operated in 1891, doing the same operation as described by Dr. Park, except that the bone was cut off and wired to the carpal bones. The result was excellent.

Dr. Sayre asked if Dr. Park had experienced any difficulty in holding the hand in position. In one that he had done some years ago he had removed one of the carpal bones and stuck the end of the ulna into the gap thus formed, but he had experienced more or less difficulty in maintaining the improved position.

Dr. Park said that he had had difficulty, and that had been the reason for taking out a portion of the first row of the carpus in order to get sufficient room. Regarding the case of wry neck, he would say that on the left side he could not identify the nerves, although he had hunted especially for the cervical nerve. They were too wrapped up in exudate to be distinguishable. These operations on nerves were not always followed by a permanent result. Ten or twelve years ago he had operated repeatedly upon a bad case of wry-neck, taking out first the spinal accessory. The trouble had returned, so he had done an extensive operation; but another recurrence had taken place, and the man had disappeared from his observation. Last year, however, the man had come to him, stating that he had been well for three or four years. Strangely enough, the case had recovered spontaneously after several years, no other operation having been done.

# FURTHER OBSERVATIONS ON RAPID OSTEOCLASIS FOR THE CORRECTION OF RHACHITIC DEFORMITIES OF THE LEGS.

By WALLACE BLANCHARD, M.D.,
CHICAGO.

The subject of rapid osteoclasis for the correction of rhachitic deformities of the legs is a field that broadens largely when we come to study the many procedures that must be varied to meet the different forms of deformity in order to get the best results.

Some forty years ago several osteoclasts, including the Rizzoli, were in use; but almost up to the present time osteoclasis has failed to gain the standing to which its many advantages entitled it, for one reason—that until the Grattan was perfected no osteoclast united practically unlimited strength with absolute precision, even to use on the verge of a joint, and, for another reason, that the method in the use of the osteoclast was faulty.

Loss of time in the handling of the instrument made contused wounds and other injuries, causing great temerity; and temerity, again, caused more loss of time and more severe injuries to the soft parts, so that the osteoclast fell into disrepute.

With the term rapid osteoclasis a new start was made that was unhampered by the old and only too well-founded objections; and I am now able to report on 262 cases of bowlegs, knock-knees, and anterior curved tibias corrected by rapid osteoclasis and osteocampsis, without a single case presenting any injury, even so slight as an abrasion to the soft parts, without anything but a simple fracture or bend and without a single delayed union, and, so far as known, without an epiphyseal separation.

The ages varied from four to sixteen years, the average being seven years and nine months.

The compression time in the osteoclast in no case exceeded eight seconds, and the time for all the details of the operation from the start to the setting of the plaster-of-Paris and removal from the table seldom exceeded five and one-half minutes.

All of these 262 cases were either perfectly corrected or so nearly so as to be straight for all practical purposes of use or appearance.

The superiority of the ultimate results of osteoclasis over osteotomy, either cuneiform or linear, for anterior curved tibias can hardly be estimated by one who has not seen a large number of dwarfed children changed to an average height.

The elongation of the legs resulting from the operation for the correction of anterior bent tibias, as presented in my paper entitled "Rapid Osteoclasis for the Correction of Rhachitic Deformities of the Legs," read before this Association at its last meeting, has been frequently commented upon as a "slight lengthening."

In view of the lengthening that I believe I have shown was almost invariably obtained, I could not but view this comment as considerably minimizing my results.

When the tibias, as is usually the case, are lengthened fully one inch, and the patient is changed from the semblance of a dwarf to normal height for the age, at the same time that the bent legs are made perfectly straight, the criticism may seem to be hardly fair.

I submit that the stunted appearance is one of the most serious aspects of the deformity, and that its correction is just as desirable as that of the deformity itself, and in thirty consecutive cases of anterior curved tibias operated upon there was found to be an average lengthening of nine and seven-tenths per cent.

Fig. 1 is a cut of a horizontal view of a leg with an anterior curved tibia. The length of this tibia was eight and one-half inches.

Fig. 2 shows the same leg after straightening by rapid osteoclasis and the opening up by manual force of a posterior triangular space in the tibia. The leg is seen to be considerably slimmer as well as longer, and the length of the tibia has been increased just one inch, making it nine and one-half inches in length.

Fig. 3 is from an X-ray of the same leg, taken two months after the operation, and shows to advantage the triangular space opened up in the posterior portion of the shaft of the tibia. The increased density of the new bone is shown in the darkness of the filled-in

triangular space. As is usual, the fibula fractured at the same level as the tibia and was the first to break. Because of the thin-

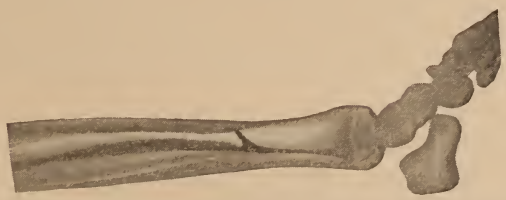
FIG. 1.

A horizontal view of a leg with an anterior curved tibia.

FIG. 2.

The same leg after straightening by rapid osteoclasis and the opening up of a posterior triangular space in the tibia by which the tibia was lengthened just one inch.

FIG. 3.



From an X-ray of the same leg two months after the correction. It shows a dark wedge of new bone filling the triangular space opened up in the posterior portion of the shaft of the tibia in the straightening and lengthening of the leg.

ness of the connecting strip of reparative bone its shadow does not show much darker, but that its union is a good one is indicated by its slightly uneven continuity.

Of all the cases noted of anterior tibias 4 per cent. were unaccompanied with any other deformity of the legs, 15 per cent. were accompanied with bowlegs, 14 per cent. with unilateral knock-knees, and 67 per cent. with bilateral knock-knees. The anterior curved tibias were bent, almost invariably, a little inward as well as forward, and it was found that the anterior curved tibias were accompanied by bowlegs only when the bowlegs were a prior deformity.

Why so large a majority of the cases of anterior curved tibias should present bilateral knock-knees became naturally a most interesting subject of investigation.

It was observed that when the initial deviation from the normal was anterior bent tibias, unilateral knock-knees resulted. It was also observed in the cases seen in the early stages that knock-knees developed on the same side with the anterior curved tibia that first developed a bend, and that the knee fell inward so rapidly as to push against the opposite knee, acting as a strong prop in keeping the other leg straight, even though the other tibia later took on the more severe curve of the two.

Anterior bent tibias, with corkscrew curves in many and devious directions, were occasionally seen, and they were always treated in the same manner as the uncomplicated anterior curved tibias, except that when the posterior triangular space was opened up in the tibias by manual force after the lateral fracture in the osteoclast, a corrective twist to the bone was given, which was maintained when it was put up in plaster.

Fig. 4 shows a case presenting anterior bent tibias and practically a unilateral knock-knee of the left side, for the right knee falls inward but slightly, and is interesting as showing the condition that so frequently obtains.

The left tibia in this case was undoubtedly the first to develop an anterior and slightly inward curve, throwing a leverage inward upon the left leg, which rapidly developed the condition of knock-knee, and this left knee pressed so strongly against the right as to hold it well in place, preventing the development of any very pronounced condition of knock-knee in the right leg, as the right tibia bent into an anterior curve similar to the left, so that when the case was operated upon for anterior curved tibias, and a supra-

condyloid osteoclasis of the left femur was performed for the correction of the knock-knee of the left side, the only operation necessary for knock-knee of the right side was a slight supracondyloid osteocampsis of the right femur.

It will be seen in Fig. 5, which is a cut of the same case in plaster-of-Paris immediately after the operation, that the outward bend in the plaster-covered left leg corresponds very nearly with the inward bend before the operation, and this commensurate over-correction is what leaves us a straight leg after the plaster has been removed, as is seen in Fig. 6.

FIG. 4. FIG. 5. FIG. 6.

FIG. 4.—A case of anterior curved tibias and unilateral genu valgum of the left leg, with only a slight tendency toward genu valgum of the right leg.

FIG. 5.—The same case in plaster-of-Paris immediately after the correction of the deformities by rapid osteoclasis and osteocampsis.

FIG. 6.—The same case, when plaster dressing was removed, standing on straight legs that were lengthened one and one-quarter inches.

The fracturing of the anterior bent tibias and opening up of posterior triangular spaces lengthened the legs in this case fully one and one-quarter inches, and the dwarfed patient, besides walking upon straight legs, became of average height for his age.

The flat-foot, with more or less eversion, that so frequently accompanies and is produced by genu valgum is not the ordinary condition of uncomplicated flat-foot, but rather that the centre of gravity has fallen inside the inner margin of the foot, placing the

arch at a disadvantage and causing an overstrain, from which the foot, as a rule, sufficiently recovers immediately on the correction of the genu valgum.

Two recent authors condemn osteoclasis because, they say, they have perfectly corrected knock-knees and bowlegs with the osteoclast, and have put them up perfectly straight in plaster-of-Paris only to find, six weeks later, when the dressings have been removed, that the legs were not "really straight," and more operations would have to be performed for the correction of the deformities.

I can only view the putting up of corrected femurs and tibias for the correction of lateral deformities in a "perfectly corrected position" as a very grave mistake.

Perhaps too great stress cannot be laid upon the necessity of putting up these legs in a highly exaggerated overcorrected position.

A little overcorrection often seems at the time of the operation to be a great deal, and may at the same time be entirely insufficient, so that nothing less than an overcorrection to the same degree as the original deformity should be depended upon.

In fact, when the tibias have been fractured at the upper third for the correction of bad bowlegs the legs should be put up in plaster in such an overcorrected position as to resemble a case of knock-knee of the same degree of severity; and when knock-knees are to be corrected by the fracturing of the upper ends of the tibias they should be put up in plaster so as to represent a case of bowlegs of just as severe type, and, when taken out of plaster five or six weeks later, the results will be found to be remarkably perfect.

The maximum amount of force for exaggerated overcorrection should be applied as the plaster sets, and in case of a supracondyloid fracture or of a fracture of the tibia near its upper end the knee, including the condyles and the head of the tibia, should be grasped firmly with one hand and the distal portion of the shaft of the bone operated upon with the other, so that no severe strain is produced upon the lateral ligaments.

Fig. 7 shows a case of bowleg of the right side of considerable severity, and of mild bowleg of the left side. Fig. 8 is a second cut of this case, and shows the legs in plaster-of-Paris, immediately after rapid osteoclasis, at the upper third of the tibias and exaggerated overcorrection to a degree commensurate with the original

deformities, the bowlegs being made to look like knock-knees of about the same degree of severity; and it will be seen in Fig. 9, which is a third cut of the same case, that the result when the plaster has been removed is quite perfect.

This case also illustrates to advantage bowlegs dependent on the four conditions of outward bends in the upper thirds of the femurs, large outer condyles, inward obliquity of the femoral articulating surfaces of the tibias, and outward bends in the lower ends of the tibias. These widely separated contributing distor-

FIG. 7. FIG. 8. FIG. 9.

FIG. 7.—A case of quite marked genu varum of the right side and of mild genu varum of the other side.

FIG. 8.—Shows the case in plaster-of-Paris immediately after the one operation on each leg of rapid osteoclasis of the tibias at their upper thirds and exaggerated overcorrection to a degree commensurate with the original deformities.

FIG. 9.—The same case after removal of the plaster, showing that the commensurate exaggerated overcorrection at the upper thirds of the tibias has assimilated into the general contour of the legs, making them straight and symmetrical.

tions were all corrected by the one operation, on each leg, of rapid osteoclasis and exaggerated overcorrection at the upper thirds of the tibias. It will be seen that perfect symmetry results from the exaggerated overcorrection being assimilated into the general contours of the legs.

Usually the subjects of bowlegs and knock-knees are not as markedly dwarfed as the anterior curved tibia cases, but all are shortened to a greater or less extent; and when the tibias and

femurs are fractured and put into positions of exaggerated overcorrection for the cure of these deformities there is always a triangular space opened up in the bone from one-quarter to three-quarters as wide as in anterior curved tibias, and the legs are lengthened correspondingly. The patient with corrected bowlegs, Fig. 9, stood with legs half an inch longer than before the operation.

In order to fracture the bone in the direction of least resistance it was frequently advisable to break it in the same direction as the deformity, so that for the seven or eight seconds that the leg was in the osteoclast the deformity was perhaps more than doubled. The fracture having been made complete and the leg removed from the osteoclast, the direction was reversed by manual force to a point of commensurate exaggerated overcorrection, and so maintained until the plaster-of-Paris dressing had been applied and had firmly set. The results of this procedure have been highly satisfactory in every instance.

It sometimes happens in the same case that the tibia fractures quickly and the femur bends to any desired angle without fracturing. In fully 50 per cent. of the supracondyloid corrections nothing more than an easily obtained osteocampsis was necessary, while in many cases it was uncertain, when the desired correction or overcorrection had been made, whether the bone had gone from the indented stage of an osteocampsis to a three-fourths fracture or not.

In the normal condition the articulating surface of the head of the tibia with the femur presents, except for a slight downward slant from without inward to accommodate the longer inner condyle, an undulating but fairly level table for the condyles to rest upon; but any lateral bend in the shaft of the tibia, more especially in its upper third, tips it correspondingly. Perhaps this condition is as often to blame for genu varum and genu valgum as are elongated outer and inner condyles, and frequently we have found the fault to be more or less evenly divided.

Dr. Lorenz, of Vienna, claims that the long inner condyle draws up or diminishes when in genu valgum the external lateral ligament is forcibly overstretched and the leg is put up in plaster for six weeks and then braced for a year or more. Others claim that when this is done the short condyle elongates or in some way increases as the months and years go by.

Perhaps both happen to some slight extent, but the process is far too doubtful of accomplishment as well as too painfully slow and tedious for practical use. The Wolff method is even slower and more painfully tedious than the Lorenz. I believe it may fairly be said that the time is past when more than six weeks should be taken for the perfect correction of a great majority of these deformities.

I have had several cases of severe bowlegs in children from one to three years of age, with the bones still in a pliable condition, in which I have bent the tibias by mild manual force, without anæsthesia and without any severe pain, and put them in plaster, repeating the operation every two weeks, and in from one to two months obtained straight legs.

In this process, which may be termed progressive manual osteocampsis, to get the best results the maximum amount of force should be applied while the plaster is setting.

After the legs have been straightened they should be kept in plaster, or some other support substituted, until the bone has gained sufficient firmness to carry the child without bending under its weight. These cases were not included in the 262 cases reported upon.

It is frequently noticed that bowlegs that form from the sixth month to the second year, and are of a mild type, are self-correcting to a considerable degree between the ages of two and four, but never after the fifth year, while in the more pronounced cases the greater leverage prevents any autocorrection whatever. It is undoubtedly true that knock-knees with anterior curved tibias are never self-correcting at any stage or age.

As a result of the indiscriminate application of iron braces to all the conditions to which they can possibly be attached we are called upon to consider the deformities and diseases which they produce; and in some instances we find the brace produced deformities much more intractable than the original.

Thirty-one per cent. of the cases of bowlegs and knock-knees operated upon had loose knee-joints of greater or less severity. A few were so marked that when the legs were held in a fully extended position a passive lateral rocking movement would separate the outer and inner condyles alternately from their articulations,

apparently from an eighth to half an inch, and with a clicking sound that could be heard all over the room.

About 25 per cent. of these loose joints were produced by the leverage strain on the lateral ligaments by the deformities misdirecting the weight of the body, and the other 75 per cent. were produced by the ignorant handling of the supposedly corrective iron braces, usually by instrument-makers and occasionally by those who should have known better.

In a few of these cases there was so much laxity of the lateral ligaments of the knee that, after the long bones had been straightened, the patient, when standing, could flop the legs at pleasure into bowlegs or knock-knees, but was unable to avoid one or the other of these positions.

In genu valgum the external lateral ligament is relaxed, and in genu varum the internal lateral ligament is relaxed; and when the external lateral ligament is found to be overdistended in association with genu valgum, or the internal lateral ligament is overstretched with genu varum, and there have been no operative procedures, they are almost necessarily brace produced. The abusive misapplication of iron braces only emphasizes the fact that they should not be used except under the direction of competent orthopedic surgeons.

Of course, the first step to the relief of loose joints must be the removal of the cause of lateral tension of the ligaments, whether of misapplied braces, of knock-knees, or of bowlegs. A great majority of all the lax joints, including some of the most severe cases, tightened up rapidly as soon as all the lateral tension was relieved.

A month since, with a view of obtaining X-ray pictures of bad loose joints in various positions, I had the matron of the Home for Destitute Crippled Children send out for all the cases of crooked legs that had been straightened and discharged with loose joints during the preceding year, and these included several quite severe cases. Sixteen responded. Only two of the sixteen wore supporting braces, and I was considerably gratified to find that since they had been walking on straight legs the lateral ligaments had tightened up so rapidly that most of them had entirely recovered, and not a single typical case of loose joint remained among them.

These cases would seem to show that artificial support is seldom necessary, and that loose joints will usually tighten up in from three months to a year after the straightening of the bones of the legs has taken the strain off the lateral ligaments.

It still remains, however, that these conditions, when very severe, are most deplorable; and I believe that nothing avails after straightening the legs but mechanical supports to prevent them from falling in and out until the lateral tendons have tightened up, and occasionally this may be a matter of years. Thus while the original deformities could have been entirely corrected in five to six weeks, it may take as many months or possibly as many years to recover from the evil effects of the braces.

I estimate that in fully 80 per cent. of the braced cases of bowlegs and knock-knees that come under my observation the bones have consolidated so that brace force applied for any number of years cannot bend the bone to any appreciable extent. When the bones harden after rickets they never, or at least very seldom, stop at normal consolidation, but usually from the fifth to the seventh year go on to a firmness equal to advanced middle if not old age; and it would be laughable, if it were not pitiable, to see iron braces by the hundreds on these consolidated cases that nothing short of a fracturing force can affect one iota. As for anterior curved tibias, observation and experience alike demonstrate beyond question that they are never improved by iron braces at any stage in their progress.

Is it too much to hope that we will soon see the passing of the frequently much worse than useless iron braces that are weighting down and causing years of misery to so many thousands of children afflicted with bowlegs, knock-knees, and anterior curved tibias?

The simplification of the correction of rhachitic deformities of the legs by rapid osteoclasis will certainly largely contribute to this most desirable end.

The last two orthopedic surgeries published are by Dr. Charles Bell Keetley, of London, England, and Dr. Royal Whitman, of New York. Dr. Keetley has a good illustration of the perfected Grattan osteoclast, but the book contains no intimation of the capabilities of the instrument, and his low estimate of osteoclasis

in general may be gathered from the fact that he commends osteotomy at every point where osteoclasis could be employed to the best advantage. Dr. Whitman barely touches the subject except to say that supracondyloid corrections with the osteoclast require considerable force, and that "there might be danger of separating the epiphysis or otherwise injuring the joint." A rather extensive practical experience would seem to demonstrate conclusively that

FIG. 10.

The Grattan osteoclast, with a leg in position for the fracturing or bending of the tibia at the upper third. In this view the long pressure screw of the osteoclast is hidden behind the main upright.

these fears, both as to the epiphysis and the joint, are absolutely groundless.

A great injury is being done to the cause of rapid osteoclasis by an instrument that is being largely put on the market by instrument makers which purports to be a Grattan osteoclast, but which in fact, compared to that instrument, is a very fragile and toy-like affair. The weight of the perfected Grattan osteoclast is thirty-six and three-quarter pounds. It should be understood that the great

weight and strength of the Grattan gives it that stability and force that enables the operator to be invariably successful in obtaining a simple fracture at the exact point desired, with the least expense of force, and in eight seconds.

Osteoclasis should not be performed for the correction of rhachitic deformities of the legs until the bones have become so firm as to support the weight of the child without the least bending, but experience shows that no exact age can be given—generally any time after the sixth year, but sometimes the texture of the bones is sufficiently firm at five and occasionally even at four.

The unexampled rapidity, as well as the absence of pain, following rapid osteoclasis; the freedom from the dangers attending bloody operations; the saving of time and expense in antiseptic precautions and after-care of open wounds; the lengthening instead of shortening of the legs of the frequently already dwarfed, are among the many undeniable advantages of rapid osteoclasis over osteotomy.

If I have spoken positively it has been with the desire to impress more strongly the brilliant results attained by rapid osteoclasis and osteocampsis with the perfected Grattan osteoclast, and to prove it to be the duty of the orthopedic surgeon in these rhachitic deformities to give the patient straight and serviceable legs with the fewest operations, the least danger and pain, and in the shortest possible time.

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## DISCUSSION.

Dr. Phelps said that Dr. Grattan came to New York in 1892, and in the Hospital for Ruptured and Crippled gave a clinic at which he operated. He produced a compound fracture in almost every instance. The probable reason for this was that there was a mandril hole which cut to the bone. The instrument just presented was not the original one, and, although quite heavily made, the screw was not such as it should be. He used in New York a larger and multiplying screw. In the adult, with the small screw and straight jack, he believed a compound fracture would be produced nine times out of ten. It was for this reason that he

had suggested to Grattan the use of the curved jack. The improved osteoclast had been published by the speaker in the *Medical Record* in 1894 or 1895. Dr. Blanchard's paper was the third statistical paper on this subject. It was not generally known that Dr. Charles T. Poore, of New York, had nearly lost his reputation, some years ago, by writing a book recommending osteoclasis, just as had been done by Dr. Blanchard. At that time no one would listen to osteoclasis, osteotomy being considered the proper thing.

Dr. Ridlon. I wish to contradict the statements made by Dr. Phelps. Poor Grattan is dead. He was my friend. And no man shall, unchallenged, so grossly misrepresent him and his work. Grattan came to New York on my invitation. I saw all the work he did while there, and in no instance did he make a compound fracture; in no instance did he cut to the bone; in no instance did he cut through the skin.

Dr. Porter, of Chicago, said that Dr. Blanchard had not dwelt sufficiently upon the bad results alluded to by Dr. Phelps. He had assisted at most of the 260 cases done by Dr. Blanchard. Most of them had been done with the original Grattan osteoclast, and he wished to say that he had never seen the slightest injury, even to the soft tissues. He had never seen a pressure-sore or a sloughing of the soft tissues, much less a compound fracture.

Dr. Sayre said he noticed that the screw on this instrument was nickelplated, yet Grattan had told him that this was undesirable, because the plating would pull off and cause a jamming of the screw.

Dr. Porter replied that in this instrument the mountings were plated, but not the screw itself.

Dr. Ridlon said that he had believed the curved jack a valuable modification until he had tried it in an osteoclast which he had devised some three or four years ago, but on using it had torn the skin twice out of three times, and had consequently dis-

carded it. Grattan had rejected the curved jack as theoretically wrong. In so far as the wobbling of the jack in the first Grattan instrument was concerned, he would say that the skin had not been cut because of the wobbling; indeed, the skin had not been cut by Grattan in any instance. He had discarded the hand-bar for steadying the jack, and had substituted the sliding-bar so as to dispense with an assistant when using the instrument.

Dr. Ridlon said that he had seen many of Grattan's cases in Cork; he had the photographs and records of a large number of them ; and he had seen all but one or two that had been operated upon with the Grattan instrument in Chicago, and in no instance was the skin cut through. The cases done by Dr. Blanchard and himself showed that whatever wobbling there might have been had not even abraded the superficial layer of the skin. It was important that the operation should be a rapid one and that the pressure should not be kept up any longer than actually necessary, for Dr. Gibney had reported at one time the occurrence of a slough from the use of the Thomas wrench. He would say, in passing, that the Thomas wrench had never caused a slough in his own hands. He had used the Thomas osteoclast on a femur, in an adult, and had bent the instrument without breaking the bone. Subsequent operation showed that it had indented the bone deeply, but had not injured the soft parts at all. Cutting down to the bone or cutting through the skin should not occur with any proper osteoclast used in a proper way; such a thing was wholly imaginary. Dr. Phelps had suggested that the men in Chicago might lose their reputation by doing osteoclasis, just as Dr. Poore had lost his. In reply he would only say that he would like to have as good a reputation as Dr. Poore has in his city.

Dr. Whitman said that at the Hospital for Ruptured and Crippled, where subcutaneous osteotomy was usually performed, there had been, he believed, no accidents whatever, making the record as clean as that of the reader of the paper; in other words, his objections do not apply to subcutaneous osteotomy. He had at one time used the Rizolli osteoclast, and the extreme bending of the bones before breaking, and the uncertainty as to the point of fracture, led him to favor osteotomy, which is done so easily

and gently and without risk. Personally, he thought the Grattan instrument was an admirable one. He had been deeply interested in the paper, and particularly in the comparative ease with which the anterior curves had been corrected. He himself preferred to do simple osteotomy, forcing the bones backward; but in doing this one must divide the tendo Achillis and use considerable force.

Dr. Weigel passed around a radiograph from a case of anterior curvature which had been operated upon by cuneiform section, and which was done very badly. The radiograph showed absence of normal structure.

Dr. Phelps said that if Dr. Ridlon had lived at the time Dr. Poore did, when no one believed in osteoclasis, the conditions would have been different. Everyone believes in osteoclasis now, but it was entirely different twenty years ago, and hence Dr. Poore suffered because he was a pioneer in this field.

Dr. Blanchard, in closing the discussion, said that 265 successful cases done without any abrasion of the skin would seem to be sufficient to demonstrate that the osteoclast was a perfectly safe instrument in the hands of an operator who manipulated it with sufficient rapidity and adjusted it properly. He operated with the utmost confidence, and it never required more than eight seconds to do the operations. In cases of anterior double curves, lateral breaks must be made, and frequently it was necessary to tenotomize the tendo Achillis, as otherwise the tendon would not lengthen sufficiently to allow the leg to be brought out straight. Osteoclasis and osteocampsis are not applicable to the femur except at its lower end.

# THE TYPHOID SPINE.

By WILLIAM J. TAYLOR, M.D.,
PHILADELPHIA.

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Since Dr. Gibney's original paper was read before this Association describing a very painful sequel of typhoid fever, which he called the "typhoid spine," and described as a perispondylitis, various articles have appeared by different writers under this heading. The cases described by them differ very materially in their history and their symptoms, and my object in writing this paper is to report in full one case and to try to reconcile somewhat the different opinions.

There are certainly three distinct conditions of the spine which may arise after typhoid fever: First, the true perispondylitis of Gibney; second, a painful condition of the muscles of the spine, resulting from a mechanical strain or injury, and which is not a perispondylitis; and, third, the hypersensitive, neurasthenic, painful spine, which is merely a neurosis, and consequently not based upon the same pathological findings.

Dr. Osler, in his paper (*Johns Hopkins Hospital Reports*), does not define these differences with clearness. He classifies all of these conditions under one heading, and is inclined to believe that all are bordering upon neurasthenia. Dr. Keen (*The Surgical Sequels and Complications of Typhoid Fever*) does not even mention this so-called typhoid spine, believing that it is merely a functional neurosis and not due to any pathological lesion. He thus dismisses the subject as not being a surgical complication. I think, however, that if the reports of the various cases and their histories be studied with care, and especially if the one case which has come under my own personal observation—the history of which I give here in full—be given due consideration, it will

be seen that a definite pronounced affection of the tissues, periosteum, ligaments, and deep fascia is occasionally met with, and that it is distinctly a surgical sequel of this most prevalent and all-pervading malady.

The argument which has been advanced that the typhoid bacillus, if it find a lodgement in any of the periosteal tissues, is prone to remain and produce suppuration is, of course, well recognized; but it is not always the case by any means, for most of us have seen a marked periostitis of the shin bone, which in the course of time subsides or leaves only a thickening of the tissues, and resolution occurs without suppuration and subsequent necrosis of the underlying bone. If this occurs in the shin bone—and it undoutedly occurs in other bones as well—why may it not also occur in the spine?

The case which I have to report is that of a man, aged twenty-seven years, a pattern-maker, who was referred to me by Dr. Wharton Sinkler in May, 1899. The family history was good. He had had measles, scarlet fever, and diphtheria when a child, and inflammatory rheumatism two years before the present attack. He had used alcohol and tobacco moderately, and had had one attack of gonorrhœa ten years ago.

He was taken with typhoid fever February 4, 1899, and was in bed for nine weeks. The attack was quite severe, but there was nothing special about it. At the end of this time he got up and was about for a few days. He then began to have pain in the back, which was especially marked in the lumbar region and about the hips. On May 8th he had to go to bed, as the pain was so intense and extended along the whole spine, but had now become localized in the lumbar region. When he was admitted to the Orthopedic Hospital he had not slept for three nights because of pain, which was dull and heavy, but not shooting. The right hip was painful, with numbness extending to the knee; the appetite good, the bowels constipated, the knee-jerks active, being slightly increased, the sensations normal, and there was no ankle clonus. There was a slight prominence of the spine to the right of the sacrum and also in the lumbar region, and his pain was increased very much on turning from side to side. The urine contained

hyaline and granular casts, with pus and blood, which was probably due to some kidney complication during his fever.

At first he was treated—on the supposition that his condition was due to neurasthenia—by massage, electricity, trional at night, and a liberal diet, but by the end of a week a diagnosis of Gibney's post-typhoid spine was made. His temperature was slightly above normal, but by the 20th he developed a large alveolar abscess on the right side of the jaw, which materially increased his fever. His average range of temperature was from 102 to 99° F., with a morning fall to normal or nearly so. His appetite continued good, and he was fairly comfortable as long as he remained in bed without moving his spine. His slightest efforts, however, to move, either turning in bed or in an attempt to sit up, brought on agonizing pain.

One very peculiar symptom which was noticed in the early part of his spinal trouble was a condition of tremor or rhythmic palpitation of the abdominal walls. Such a condition I have never seen before or since, and it would occur almost invariably when his abdomen was exposed in an attempt to make a physical examination. He was given salicylates, tonics, and rest, but no attempt was made to fit him with a jacket or get him out of bed. He had certain of the stigmata of hysteria, it is true, but there was undoubtedly a true pathological process in the lumbar spine which produced thickening, and a slight posterior deformity which was very distinct. Several attempts were made after he had been in bed for nearly two months to get him out of bed, but each time the pain was so severe that he was obliged to remain quiet. His pain gradually grew less, his general health improved, the thickening about the spine subsided, the rigidity became less pronounced, and by the first of September he was able to be up and about the wards, and was shortly after discharged from the hospital, apparently perfectly well, with all of the movements of the spine perfectly normal and with no pain whatever.

I saw him last on February 25, 1900, when he came, at my request, to enable me to examine his back. He had had no pain whatever since leaving the hospital in September, and had been working steadily as a draughtsman. The spine is perfectly flexible in all directions, the thickening which formerly extended into the

lumbar region had now entirely disappeared, and he considered himself to be absolutely well.

I have lately heard from him (May 6, 1901), and learned that he has been entirely well, with no return whatever of pain or any symptoms referable to his spine.

While I believe that the majority of cases of painful spine after typhoid fever are neuroses known as spinal irritation, you cannot have pain, thickening, tenderness, and deformity without there being a definite pathological lesion. In my own case all of these conditions were present. They were not such as you would expect to see in a tuberculous condition, nor would the subsequent history at all lead to this as an explanation. Recovery was too prompt and apparently without any limitation as to the flexibility of the spine, nor had there been any persistence of deformity. The symptoms as generally described have come on either late in the convalescence or after the patient has recovered from typhoid fever and returned to work. In most cases there is no history of injury, but this has been present in some. The pain is, as a rule, in the lumbar region—intense, sharp, and shooting in character —which is comparatively bearable as long as the patient is lying flat on his back, but is much aggravated by any movement of the spine either antero-posteriorly or laterally. Even turning in bed is extremely painful, and it is only by making a muscular effort and fixing the spine by all the voluntary muscles that it can be accomplished, and then only by the aid of the nurse.

Deformity has been present, more or less marked, in every case where a true pathological lesion could be considered; but in those where the neurotic element far outbalances the local conditions this is not seen.

Osler's second case, a man, aged twenty-four years, after a convalescence from typhoid fever, had some pain in the back, but was up and about and even able to play tennis. After a fall he suffered excruciating pain in the lumbar region, and could only rest in the recumbent posture. Deep pressure over the iliac region on the left side and antero-posterior motion caused excessive pain; there was some fever. These symptoms continued from the end of November to January, and it was March before he was well.

Pepper mentions (*American Text-book of Medicine*) a condition of obstinate periostitis of the front of the spinal column resulting from typhoid fever.

Periosteal thickening may disappear without suppuration, but we do not have protracted periosteal thickening lasting for weeks and months, as a rule, without suppuration; and it is very difficult to conceive of any attack of pain lasting for months as a result of a simple perispondylitis, and yet none of these cases has passed on to the formation of pus.

Lovett and Withington (*Boston Medical and Surgical Journal*, March 29, 1900, p. 317) report a very interesting case where there was undoubtedly a mild, self-limited osteomyelitis of the bodies of the vertebra, which was attended with nervous symptoms of a character usually considered hysterical, and yet having at the same time pressure phenomena. Unfortunately, in our study of these cases, no opportunity has been given for careful pathological study, as, without exception, all have recovered.

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## DISCUSSION.

Dr. Freiberg said that in view of the paucity of cases of the variety reported in this paper he desired to place on record his own experience. He now had under observation a case which coincided quite closely with the one just reported. His patient was an Italian boy, aged sixteen years, robust in appearance, and said to have been perfectly healthy until attacked by typhoid fever. It was with this illness that he had been admitted to the Cincinnati Hospital, and the diagnosis had been confirmed by the presence of the Widal reaction. The boy was about to be allowed out of bed when he was seized with severe pain in the lumbar region, not controlled by morphine. There were also stiffness of the spine and pain in the legs. After these symptoms had continued for a week the speaker had been asked to see the case. At that time the spine was exceedingly stiff, and the boy could not move in bed without suffering severe pain. There was a distinct gibbus in the lumbar spine. The temperature, which had been normal for some days, again rose to 100° F., or a little over.

He expressed the opinion that this was a case of typhoid spine, and advised that the spine be thoroughly immobilized. For that purpose the boy was transferred to the orthopedic service. He was put upon a plaster bed in the supine position, and at once stated that he was comfortable for the first time. From that time on he had been comfortable, and his recovery had been rather rapid. At the end of two weeks, although the spine was still quite stiff, there was but little pain on slight motion in bed after the removal of the plaster. He could walk around now without pain and without any support, but was not yet permitted to do so. After he had been in this plaster appliance for about one week the temperature fell to the normal, and had remained at this point since that time.

# FAT EMBOLISM IN ORTHOPEDIC SURGERY.

By F. S. COOLIDGE, M.D.,
CHICAGO.

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We are all familiar with fat embolism where, after a crushing fracture, the fat globules are picked up by the blood, travel through the veins, and are forced into the lungs by the right heart. Here they gradually collect, some escaping, while still more enter, until the lungs are plugged up and refuse to do their work. In many cases the fat emboli leave the lungs, enter the heart, and are carried away by the systemic circulation to the brain, liver, or other organs, where they may give rise to certain symptoms, or in cases of recovery are eliminated slowly by excess of oxidation, and pass out through the kidneys mostly.

Hugo Ribbert, in the *Medicinische Wochenschrift*, 1900, states that a fracture is unnecessary for the production of fat embolism. He has seen it after a shaking up of the bony system. He has caused it experimentally by bruising, without further injury, and has seen the fat enter the blood. He believes that it is this rather than the fracture which causes it. He says, furthermore, that he has seen fat embolism more frequently with fracture of the sternum, ribs, and vertebræ, because the shaking up—"erschuttung"—of the whole body is more.

In orthopedics we certainly shake up the bony system in Calot's operation. We certainly cause a great many fractures, oftentimes, with some degree of crushing, in using the osteoclast for bowlegs and knock-knee, and yet it very seldom that we have fat embolism following the operations. I have had two cases of fat embolism lately, and wish to point out the peculiarities of the cases.

The first case was in a man, aged sixty years, who had been in bed with rheumatism for over a year, with both knees flexed to

more than a right angle. The rheumatism had disappeared long since, but the deformity was such that he could not get up alone, and he was bedridden. He was informed that operation was dangerous, but he chose to run any risk rather than remain as he was. At the operation the hamstrings were cut, and the sublux-ated knees were hastily straightened, one with the Lorenz osteo-clast, the other with the hands; but although little force was used the lower end of the femur was crumpled and crushed in each leg, so that an impacted fracture resulted. He came out of ether nicely. Soon, however, he became short of breath, began to sweat profusely; his heart-beat ran up; he became increasingly cyanotic and very restless, and inside of twenty-four hours he died. I regret that there was no autopsy permitted. There was no doubt in my mind that the femora had undergone atrophy from non-use or from some other cause. The force used with the hands was altogether too little to crush a normal femur, and the crushing itself was peculiar. There was very little sound; it simply yielded a little with every pull, massing up a little ridge which could be felt on the outside.

The second case was in a man, aged twenty-four years, who, three years before, had fallen upon his back and had remained completely paralyzed for two years. Recently power had returned somewhat to such of the muscles as were not contracted, and I was operating to straighten out the flexed knees and the distorted feet. He had been in bed for three years, and the legs were atrophied. I had successfully completed the knees without fracture, and was putting a little force upon the foot preparatory to inserting the tenotome to cut the tendo-Achilles, when I felt the foot give a little, and was surprised to notice a slight crushing of the tibia and fibula just above the ankle joint. As this was exactly in the right direction, I increased the crushing sufficiently to overcome the deformity without any cutting (making an impacted fracture), and completed the operation. He rallied well from the ether, but gradually the same symptoms as mentioned before occurred—cyanosis, intense sweating, rapid pulse, quick respiration, and restlessness. These symptoms increased for two days, and gradu-ally disappeared in two days more, leaving not a trace behind.

In this case, too, there was the peculiar crushing of an atrophied

bone—a bone which had undergone fatty degeneration. The force was ridiculously small to cause fracture. It is this fatty degeneration of bone that I believe causes these cases of fat embolism, and I have learned to beware of fracturing bones which have undergone fatty degeneration. It is not so much the fat in the bone as the kind of fat. In making supracondyloid osteotomies for knock-knee in children I have seen the blood pouring from the wound filled with fat globules, so that it looked oily; but in spite of my fears of fat embolism no symptoms of it occurred.

## DISCUSSION.

Dr. W. J. Taylor asked the author if he considered that drainage after osteotomy removed the danger of this complication.

Dr. Clayton said that about two years ago he had done a Macewen osteotomy for knock-knees in a little Italian child who was rickety, but otherwise healthy. He had cut the bone on one side, and the house surgeon had done this on the other side. In one leg it had been necessary to re-introduce the osteotome. After the operation the superficial circulation became very poor, and it became necessary to cut open the casts. The child continually threw its left hand up to its head. After three or four days of very high temperature, running up to 108° F., the child died, and on autopsy fat embolism was discovered on the left side of the brain.

Dr. Coolidge said that he did not attribute the occurrence of fat embolism to the absence of drainage, because in doing osteotomy he simply inserts the osteotome, turns it around, and completes the operation, using a practically subcutaneous method. In one of his cases it was evident that there was fatty necrosis of the bone itself, because the simple grasping of the foot and turning it around was sufficient to cause crumbling of the tibia and fibula.

# THE OPERATIVE TREATMENT OF PARALYTIC TALIPES OF THE CALCANEUS TYPE.

By ROYAL WHITMAN, M.D.,
NEW YORK.

Paralytic talipes calcaneus is, as the name implies, that form of talipes characterized by a prominent heel. It is, however, far more important as a disability than as a deformity, for its cause is the loss of the principal lifting and propelling force of the body —the calf muscle. When this muscle is paralyzed the os calcis, deprived of its support, sinks downward and assumes by degrees a more or less vertical position, its posterior surface becoming inferior. Thus, the distance between the ankle-joint and the bearing surface of the heel is increased. There is not, however, except in advanced cases, persistent dorsal flexion of the foot, as is sometimes seen in the congenital form, because the acquirement in this attitude is opposed by the force of the gravity.

The most noticeable of the secondary deformities is the exaggeration of the longitudinal arch. This is caused by the approximation of the anterior and posterior supports of the foot, by the action and retraction of the remaining muscles, and by the adaptive shortening of the other tissues. These secondary changes are in great degree the effect of functional use, and are, therefore, most marked when the foot has been used for a long time without adequate mechanical protection. (Fig. 1.)

In cases of this character, with which this paper is chiefly concerned, the patient, to all intents hamstrung, stamps about on his heel very much as one would after a Pirogoff amputation, but with the added disadvantage of the insecurity due to the uncontrolled movement at the ankle-joint. The forefoot serves no function other than to fill the shoe, and in advanced cases it becomes

FIG. 1.

Talipes calcaneus due to paralysis of the calf muscle (gastrocnemius and soleus), illustrating the typical deformity of moderate degree.

FIG. 2.

Talipes calcaneo-valgus. In this case the adductors of the foot (tibialis anticus and posticus) as well as the calf muscle are paralyzed.

simply an atrophied appendage suspended from the elongated and pad-like heel.

In anterior poliomyelitis the affection, which in all but very exceptional cases is the cause of the deformity under consideration, the paralysis is by no means always limited to the calf muscle ; in many instances the adductors or abductors are involved, with consequent lateral distortion. Of this type calcaneo-valgus is the most common and the most important. (Fig. 2.)

If the calf muscle alone is paralyzed, the damage to the spinal cord being limited in area, the growth of the limb is not particularly affected, nor is the circulation greatly impaired. And, although the power of the other muscles of the posterior group is of little value as far as function is concerned, the foot remains far more normal in contour and life-like in appearance than when the paralysis is more extensive. In almost every instance, however, the growth of the foot is retarded, far more so than when the muscles of the anterior group are paralyzed. This is a striking example of the effect of loss of function on development.

As has been stated, deformity is favored and induced by functional use, and, while it may be admitted that efficient protection would in great degree prevent the secondary and characteristic distortions, yet the general results of mechanical treatment, judged from actual observation, are very unsatisfactory.

The reason is apparent. When the anterior muscles are paralyzed the function of the brace is simply to prevent toe-drop, but when the power of the calf muscle is lost the support must withstand the weight of the body and the strain of locomotion. Under this strain the springs and elastic bands, so often employed with the aim of replacing muscular action, give way, and even braces of more solid construction bend and break with discouraging frequency.

The expense of apparatus and the constant need of repairs account doubtless for the fact that, in the majority of cases, braces are inefficient, or are worn intermittently, or are discarded altogether ; consequently the deformity develops, often to an extreme degree. This is especially true of the cases of calcaneo-valgus because of the difficulty of controlling the lateral deformity and because of the discomfort often caused by the restraining support.

It is in cases of this type that one turns to operative treatment in the hope of restoring the symmetry of the foot and of palliating the disability, in so far at least as to make support less burdensome and more effective.

In the consideration of this form of treatment tenotomies, forcible correction and the like, which are undertaken simply to overcome secondary deformity, do not require comment. The other procedures which are at the present time advocated are Willett's operation and its modifications, tendon transplantation, and arthrodesis. These may be considered in order.

Willett's Operation consists essentially in dividing and shortening the tendo Achillis, together with the overlying fascia and skin on the back of the ankle, sufficiently to hold the foot at a right angle with the leg, or, as modified by Gibney, in an attitude of plantar reflexion as extreme as is practicable. The object of this operation is to oppose the resistance of the non-contractile tissues on the back of the leg to the deforming influence of functional use. Further experience has shown that except in those cases in which contractile power remains in the calf muscle the procedure, even from the palliative stand-point, is of little service other than as a means of restoring temporarily the symmetry of the foot. Furthermore, when the foot is inclined toward varus or valgus the operation is contraindicated, as the shortened tissues on the posterior aspect of the limb would tend to exaggerate the lateral deformity.

The operation of sawing off the posterior extremity of the os calcis and displacing it further downward, as suggested by Walsham, is simply another method of shortening the tendo Achillis, which has little to recommend it.

Tendon Transplantation. It is interesting to note that the first operation of tendon transplantation was performed by Nicoladoni for the relief of this deformity, the two lateral peroneii being inserted into the tendo Achillis. Yet this is the condition of all others for which the procedure, from a curative stand-point, is of least value. The calf muscle is nearly double the strength of all the other muscles of the foot combined, and more than ten times as strong as the two muscles which were used to replace it.

It is evident, then, that tendon transplantation finds its proper

place as a palliative operation which may be of advantage when one can change a force that distorts the foot to a position in which it may be of service even if slight.

Arthrodesis. This operation is performed with the aim of establishing a firm right angular ankylosis at the ankle-joint, thus allowing the patient to dispense with apparatus.

Arthrodesis at the ankle-joint is of little value when lateral distortion is present. In such cases the operation must include the subastragaloid and medio-tarsal joints also. In any event arthrodesis is likely to be disappointing if performed in childhood, as growing bone can hardly restrain so marked a tendency toward deformity. If, then, apparatus must be employed in the after-treatment, absolute fixation is undesirable because of the increase of the muscular atrophy that is likely to follow and because a certain elasticity at this joint lessens the strain upon it.

This sketch of the operative treatment presents fairly, I think, the inadequacy of each of the procedures that are recommended for the relief of this affection. Indeed, an analysis of the disability should make this evident without the test of actual experience.

As has been stated, the disability of calcaneus depends in very great degree upon the insecurity of the foot. This insecurity, although caused directly by the paralysis, is greatly exaggerated by the fact that the weight must be supported on the astragalus perched upon the displaced os calcis, and the instability is, of course, increased when there is lateral distortion of the foot. The most effective remedy, therefore, must be removal of the astragalus. Sufficient mobility is thus gained to allow of a backward displacement of the foot upon the leg, so that the body-weight, instead of falling upon an elongated heel practically in the plane of the flattened calf, is advanced toward the centre of the foot. Thus the adverse leverage which tends toward recurrence of deformity is lessened, and the symmetry of the distorted part, in great degree, is restored. Incidentally one or all of the procedures that have been described may be indicated as a subsidiary part of the treatment. In fact, the operation that I have usually performed for the relief of calcaneo-valgus might be described as astragalectomy, arthrodesis, tendon shortening, tendon transplantation, and backward displacement of the foot. Of these,

the first and last are by far the most important, in that the chief cause of the insecurity is removed by lowering and carrying forward the articulation between the leg and the foot.

The details of the operation are in brief as follows: A long curved incision is made below the external malleolus from the tendo Achillis behind to the head of the astragalus in front. The two peroneii tendons are freed and are either divided or displaced backward; the astragalus is then exposed and its extraction is usually made comparatively easy after the interosseous ligament has been divided by forcibly displacing the foot inward. The

Fig. 3.

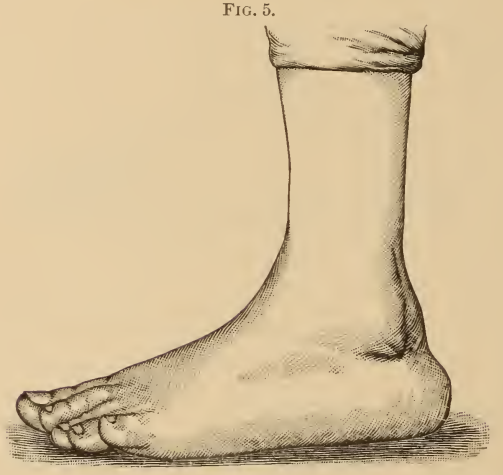
cartilage is then removed from the surfaces of all the adjacent bones; the tendo Achillis is shortened if it is longer than the new position of the foot will require, and into it are inserted and attached the proximal ends of the tendons of the two peroneii muscles, which in cases of calcaneo-valgus usually retain their power —a power that serves no useful purpose, but is simply an agent of deformity. The wound is then closed and the foot is displaced backward so that the internal malleolus is brought into contact with the scaphoid bone, and a plaster bandage is applied, fixing the foot in an attitude of slight plantar flexion. (Figs. 3, 4, and 5.)

The operation may be most conveniently performed under the Esmarch bandage, the pressure being finally relaxed, so that

bleeding-points in the skin may be secured. Subsequently the limb is elevated for a time to lessen the oozing from the denuded bones. Drainage is unnecessary. The plaster bandage remains

FIG. 4.

FIG. 5.



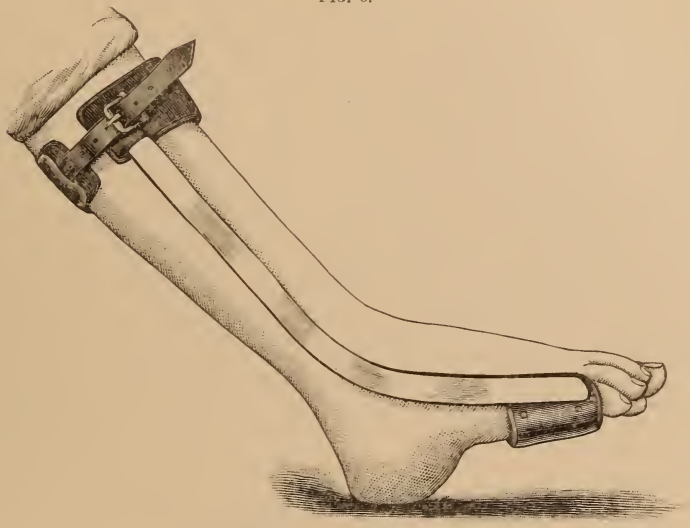
Figs. 3, 4, and 5 illustrate the effect of operative treatment in cases of paralytic talipes calcaneo-valgus.

until the parts are firmly healed, the patient being encouraged to use the foot as soon as pressure causes no discomfort, usually in from one to three weeks after the operation. In none of the operations, thirteen in number, that I have performed has there

been wound infection, and the only mishap was a superficial sloughing of the skin due to a tight bandage. This, however, in no way interfered with the success of the operation.

Although the cartilage is removed from the bones, one must not expect absolute ankylosis, as the apposition of the parts is not sufficiently perfect to assure it. In fact, as has been stated, the limited motion that remains is desirable, especially in those cases in which considerable muscular power remains, as it lessens the direct strain upon the ankle. Apparatus to prevent deformity has been employed in all cases, although the patients can walk without it very well, and it may be that in time it can be discarded.

Fig. 6.



An effective brace for talipes calcaneus.

Recently I have employed a support which seems to be a great improvement over those that I formerly used. A plaster cast of the foot and leg is made with the part in the proper attitude, and on this the brace is modelled. It consists essentially of two light curved steel bars passing from the middle of the lateral aspect of the upper quarter of the leg downward on either side, in front of or over the malleoli to the metatarso-phalangeal joints. These bars are attached to one another below by a curved foot-plate as wide as the bearing surface of the anterior part of the

foot, and above by another steel band of similar width which passes across the front of the leg in the neighborhood of the tubercle of the tibia. This is suitably padded, the circumference at this point being completed by a strap about the calf. An elevation of cork or rubber is placed in the back of the shoe to support the foot in the attitude of slight plantar flexion, corresponding to the cast. A similar thickening of the heel of the shoe, sufficient to induce very slight flexion at the knee, is of advantage also in counteracting the tendency to recurvation, which is present in certain cases. It also serves to lengthen the limb, which is usually somewhat shorter than its fellow. This brace, which is held firmly in its place by the shoe, is inconspicuous, simple in construction, and much more resistant than the ordinary brace, as the strain upon it is comparatively slight. There is consequently no likelihood of slackened straps, or of distorted uprights, or of broken foot-plates. Its use is, of course, not limited to operative cases; but as this paper is especially concerned with this class I need not consider further details of mechanical treatment. It may be noted, however, that the gait of the wearer of a wooden leg for an amputation below the knee is far better than in the majority of cases in which the essential muscles that control the foot are paralyzed. The greater, therefore, the approximation to the security assured by the artificial member the greater will be the improvement in locomotion. This is a fact not generally recognized in the construction of the ordinary brace.

It is not my purpose to urge operative treatment for all cases of calcaneus, but simply to suggest an effective procedure for those cases in which, for one reason or another, mechanical treatment is inefficient—a class which, in hospital practice at least, is a very large one.

## DISCUSSION.

Dr. Starr said he would like to ask if any difficulty had been experienced in crowding the foot backward without division of the internal lateral ligaments.

Dr. Whitman replied that he had not found any difficulty in this respect. When the astragalus had been removed considerable room was left. The backward displacement of the foot was an exceedingly important part of the procedure. The original idea was to bring the leg over the centre of the foot, thus giving the patient at least a pad to walk upon. Another reason was to bring the leg down upon the foot itself, and not have this intervening uncontrolled astragalus, which allows the lateral and posterior motion. He would recommend this procedure very highly.

# A BRACE FOR ANTERO-POSTERIOR CURVATURE OF THE SPINE.

By GWILYM G. DAVIS, M.D.,
PHILADELPHIA.

Dr. Davis exhibited a brace embodying somewhat the principles of a brace designed by the late Dr. Hoadley. It was not

Fig. 1.

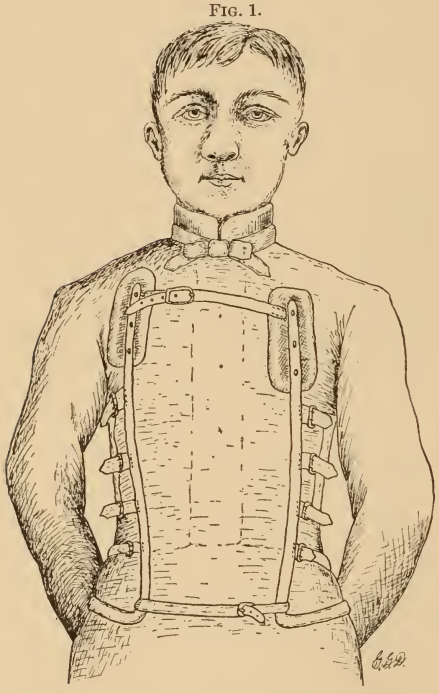
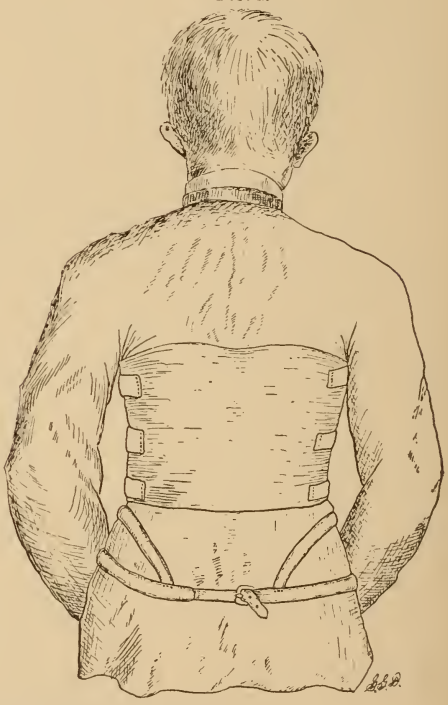


Fig. 2.



Light brace for making direct antero-posterior pressure.

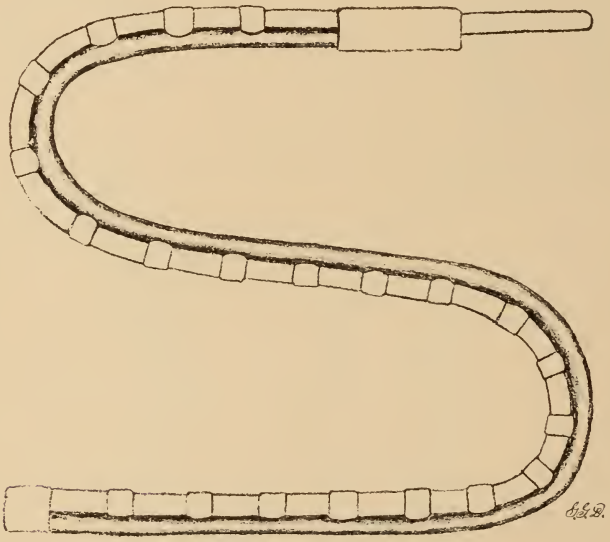
designed to secure the greatest amount of fixation, but was intended to make direct antero-posterior pressure. He had first used it in

a rheumatic affection of the spine occurring in a young man. The brace consists of two upright pieces, one of which on each side goes from below the anterior superior spine to in front of the shoulder-joint. The vertical pieces are continued horizontally around the hips between the greater trochanter and the crest of the ilium, and are held together by two straps in front, one behind and one over the crest of each ilium. There are pads which press just below the clavicles, and an apron passes from side to side across the back. The brace is pliable, and can be adjusted with wrenches in almost any direction. It is useful in those cases of caries which are in the convalescent stage.

# A FLEXIBLE CURVE AND A FLAT-FOOT PLATE.

By GWILYM G. DAVIS, M.D.,
PHILADELPHIA.

Dr. G. G. Davis exhibited an instrument for making tracings. It consists of a metal rod with a rubber tube fastened along one of its sides. It is called "a flexible curve," and may be purchased in stores having artists' supplies.



Flexible curve for taking outlines.

## A Flat-foot Plate.

Dr. G. G. Davis also exhibited a flat-foot plate made of aluminum, so that it is not only very light, but very easily worked. Aluminum if not covered is very quickly corroded by the perspiration. To obviate this difficulty he had had the metal japanned

and covered with waterproof or chrome-tanned leather. If any evidence of corrosion were observed the plate could be easily re-japanned.

## DISCUSSION.

Dr. Sayre said that one objection to the flexible curve was the impossibility of adapting it to small curves, for which purpose the ordinary flexible metal tape was better.

Dr. Weigel said that several years ago he had experimented with aluminum foot-plates, but was unable to find anything which would protect the metal from the chemical action of the perspiration. Plating this metal with silver or nickel, or japanning it, does not prevent the corrosion, which takes place after being worn for a very short time.

Dr. Whitman objected to the shape of the foot-plate exhibited, for, he said, if there were a riser on the inner side it should be sufficiently high to cover the astragalo-scaphoid joint. He had used the japanning for at least ten years applied on nickelplating. The braces were made of steel of No. 19 gauge. This was polished and nickelplated. It was very light. Patients usually have two sets of plates, in order that one pair may be kept in reserve for use when the japanning must be replaced. The great advantage of nickelplating was that the plate must be smoothly polished.

Dr. Phelps said that if the steel plate were immersed in a bath of tin it would be well protected, and could be easily retinned if required.

Dr. Davis replied that Dr. Sayre's remarks about the flexible curve were perfectly pertinent, for this instrument was not applicable to some cases, but it was useful in a large proportion. He did not feel called upon to defend the shape of the foot-plate exhibited, because it had been made by the instrument maker merely to serve as a means of illustrating how the metal could be best protected. It was evident from what had been said that nickelplating and tin plate were both imperfect.

# COCCYGODYNIA: CASE AND SPECIMEN.

By A. R. SHANDS, M.D.,
WASHINGTON, D. C.

I HAVE given the above title to my paper because of the fact that it was with the hope of affording some relief from the apparently excruciating and persistent pain in the region of the coccyx of the case under consideration, and not that any such condition was suspected to exist as the operation revealed. My diagnosis was coccygodynia, and not caries of the coccyx, as proved to be the case, as shown by the specimen here presented. The report is given with the hope that the discussion will throw some light upon this case that presented so many obscure conditions, in order that in future it may aid in diagnosing with some degree of accuracy, should any of us encounter such a case, and thereby afford more prompt relief than was done with my unfortunate patient. I do believe that there must have been some pathological connection between the suffering of this patient, which had existed several years, and this carious bone, although she had been under the care of very skilful physicians, all of whom had always attributed her suffering to hysteria, and had treated her accordingly, with absolutely no relief of her condition.

Miss B., aged twenty-two years. Family history excellent; parents living in perfect health; has also several adult sisters and brothers living; no history of any of her people being of a nervous temperament. She was a perfectly healthy child until sixteen years old, when she had a very severe attack of diphtheria, after which I am told that she was never very strong. Her illness, about to be described, began about two years after the attack of diphtheria.

In August, 1897, I was asked by Dr. Henry D. Fry, of my city, to examine her spine, as it was thought she might have some disease of her vertebral column. I found her to be an unusually well-developed woman, with no organic disease except a decided heart murmur, which I was told had never given her any special trouble. At the time that I first saw her she had been confined to her room and in bed the most of the time for about two years. Her favorite position in bed was on her side, with her knees pressing against her abdomen, heels in her nates, chin on her sternum, and her entire spinal column arched backward, very much like a cat on a rug before a warm fire on a cold day. She had been in an extremely nervous condition during this two years, and was, so she said, never free from pain in some part of her body, and often in many places at the same time. At times her pain was most severe in her stomach. At such times she would take no food. At other times it would be most severe in her abdomen, especially in her pelvis. She had always been regular in her menstruation. At times she would be very constipated, and at other times just the opposite would be the case. Headache and nausea would sometimes be almost constant for months at a time. I was told by her physican that on one occasion she vomited almost constantly for a month; during this time she was nourished altogether by enemata. At this time it was suspected that she had a cancer of the stomach, until the vomiting stopped as suddenly as it had come on, and again she took food freely with a relish. For weeks at a time she would scarcely sleep at all. Fits of low spirits were common; also fits of laughing and crying—first one and then the other. Her manner during these two years was eminently that of a hysterical person. I happened to see her on one occasion have a coughing spell which was more like the barking of a dog than a human cough. This cough would be incessant for hours, and was only relieved by a hypodermic injection of morphine, but would return just as soon as the effects of the drug wore off. She had always been opposed to the use of morphine, and it was with difficulty that she could be persuaded to allow it to be given to her. This attack of coughing lasted for three days, and stopped as suddenly as it came on, never to return, there always being something new to develop, such as

difficult breathing, almost like an attack of asthma, a choking sensation, etc.

Upon examining her spine I found it to be perfectly flexible in all directions, with no evidence of disease whatever or deformity of any description, but there was not a spot on her spine from the coccyx to the base of her skull that was not apparently painful on pressure; it did not appear to be any more so at one point than at another. My diagnosis was a hysterical spine, for I could find nothing that led me to believe but that her painful spine was only one of the many hysterical conditions that had existed all along. I wish to especially emphasize, however, that the pain in her spine was the only condition that had always been present, there never being a time that pain could not be produced by pressure on a particular spot. The physicians—and there had been many—informed me that she had had every form of hysteria known to them.

I advised the use of the Paquelin cautery to her spine. This was done freely, but with no result.

I saw nothing more of the patient until January, 1899, about eighteen months after my first examination. At this time I was consulted because she was suffering intense pain in the region of the coccyx. The pain had been severe for several months—so much so that she could not sit. I found that pain could apparently be produced by pressure at any point along the spine, but much more severe in the region of the coccyx. There was nothing that I could see or feel to account for the pain being more severe at this point; there was no redness or infiltration of the soft tissue to lead me to believe that any disease existed in this bone, but as this seemed to be the central focus of the pain I advised the removal of the coccyx. This advice was readily accepted, and accordingly the bone was removed through the sacrococcygeal synchondrosis. The specimen that I have shown you presents the following peculiarities: From the distal end of the bone there extends an osteophyte one-quarter of an inch long and about one-eighth of an inch thick, with a carious cavity involving about one-half of the new bony growth. On both sides of the last section of the coccyx there is another osteophyte—one about the size of the one described and the other about one-half that size.

In the proximal section of the coccyx there is a cavity about the size of a pea.

The wound healed by primary union, and the patient did well. The pain in the region of the coccyx was entirely relieved, and the spinal irritation was much benefited. It is a great regret that I did not have an opportunity of seeing the final result of my operation and the care that I had bestowed upon her. The patient died about four months later from a trouble independent of the spinal affection. She really died of inanition, the old nausea having returned, which prevented her from taking nourishment through the natural channel. She emaciated very rapidly, which, added to her weak heart, above referred to early in this report, caused her death.

In conclusion, I wish to inquire of this Association whether it is possible that this irritable spinal condition was started in the first instance by a reflex spasm proceeding from the coccygeal nerves which may have been irritated by the caries of the coccyx. The diseased condition and abnormal appearance of the bone surely indicates a very slow diseased process. The spinal irritation preceded all of the various hysterical symptoms that I have given, and there were many that have not been mentioned. There was no history of the patient having ever been considered of a nervous temperament until after she began to suffer with pains in her spine. If it were the case that this condition was caused by the disease in the coccyx, it is surely reasonable to believe that an early removal would have saved her years of suffering and probably have prolonged her life.

## DISCUSSION.

Dr. G. G. Davis said that affections of the coccyx were apparently so painful and annoying that he believed it was justifiable in almost all such cases to proceed at once to the extirpation of the coccyx. In very many of these cases the coccyx after removal would be found to be the seat of old fractures or luxations. Even when rectal examination failed to detect such a condition he would

still advise removal of the coccyx. A practical point in the operation was the avoidance of infection. Because of the situation of the wound deep down between the folds of the buttocks healing was apt to be extremely slow, and there was great liability to suppuration. He favored closing the wound absolutely with collodion and making an additional opening an inch or more above, and inserting a small drainage-tube. After twenty-four hours this should be removed.

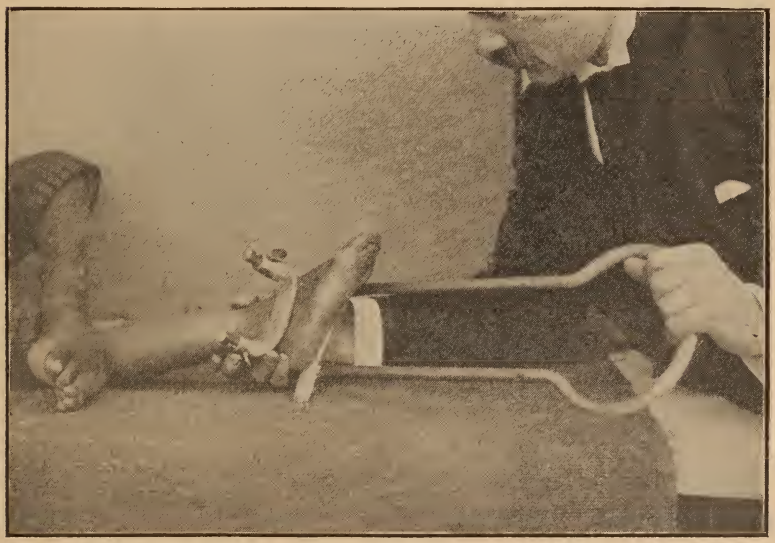
Dr. Shands said that realizing the danger of infection he had taken every precaution against it, and the wound had healed by first intention.

# A CLUB-FOOT WRENCH.

By CLARENCE L. STARR, M.D.,
TORONTO.

In the correction of deformities, either in children or adults, there is no power equal to the intelligent human hand. There is a precision and nicety of adjustment in such power that cannot be imitated by any mechanical apparatus. However, in the experience of every surgeon there come cases when the power of the unaided

Fig. 1.



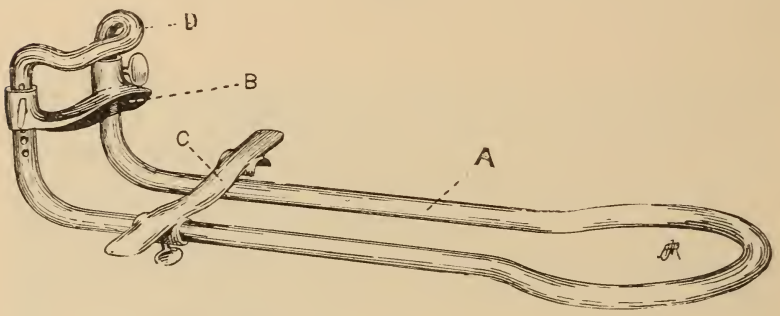
hand is not sufficient to correct the deformity, and some form of leverage is required. My colleague, Dr. George A. Peters, devised the wrench, which I present, with some slight modifications. In the stubborn, resisting cases of club-foot in older children and in adults it has proved most valuable. The power is sufficient to tear or crush any bones or soft structures in any situation, and hence the instru-

ment should be used with caution. In the hands of the writer no injury has been done to the skin or soft tissues by any degree of force necessary to correct the most resisting cases of club-foot.

It is not intended that this appliance should do away with the necessity of tenotomy and fasciotomy; but, after all resisting structures possible have been divided, the hand alone in many instances is insufficient to correct the deformity, and one must have recourse to mechanical aid. It is with a view of meeting this need that the wrench about to be described is presented.

The wrench is made of round bar steel about five-eighths of an inch in diameter. The shape is sufficiently indicated by the accompanying sketch. The reverse extremity of the wrench is expanded

Fig. 2.




into a bow shape, so that in operating, for example on an adult club-foot, the foot may be passed through this end and the wrench then slid into position. The apparatus is equipped with two movable bars—one (B) upon the upright limbs of the wrench, the other (C) upon the horizontal limbs. The bar B, as shown in the figure, is bent toward the bow end of the wrench to the extent of about an inch and a half, and is provided with two thumb-screws, which fit into small depressions on the upright limbs, so that it can be set accurately in any desired position. The bar C is attached by a close-fitting collar to one limb only of the horizontal portion of the wrench, the other end of the bar merely having a concave groove which fits upon the opposite limb. This bar is, of course, provided with a set-screw. By this means the bar can be opened out completely, so as to allow the wrench to be slid over the foot up to any desired position between B and C. The bar B is somewhat concave

on its under surface, to more accurately adapt itself to the shape of the foot. The bar C is made slightly concavo-convex on its upper surface for the same purpose. It will be observed that the bowing of bar B toward the body of the wrench allows the two bars (B and C) to be practically placed one under the other when in position on the limbs, and thus the fullest possible extent of short leverage is permitted. In operating with the wrench the skin over the part may be further protected by placing blocks of "rubber sponge" between the bars B and C and the limb. The total length of the wrench is about two feet, and the width between its limbs from centre to centre four inches. This will be found to be large enough for almost any limb, and to be also small enough for children of such an age as to require the use of such a powerful wrench.

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## DISCUSSION.

Dr. Ridlon said that he was responsible for having brought the Thomas wrench to this country. So far as the correction of the equinus pure and simple went, after the division of the tendo Achillis, he had yet to see a case which he could not correct if the patient were placed on his face and the weight of the operator were thrown upon the foot. The Thomas wrench was usually satisfactory for the correcting of varus, but sometimes, despite the powerful grip that could be had with it, it would slip with some feet. The wrench just presented not having any power of compression, would probably have the same defect. Where the deformity was very great he had found nothing equal to the original Grattan osteoclast—not the toy Grattan osteoclast used in New York. It would break any femur with perfect ease. Dr. Ridlon said that Grattan had torn one foot open along the line of the Phelps incision, and he had himself torn one open, but in that instance a tear of two inches and a half had extended along the line of the border of the sole of the foot instead of being along the line of the Phelps incision.

Dr. McCurdy said that a wrench on the same principle, though more simple, had been illustrated in a former volume of the Transactions.

Dr. Phelps said that he believed the Grattan osteoclast was one of the best instruments of its kind ever devised. He found that three or four pairs of hands piled one on top of the other, according to Wolff's method, does away with all this machinery. Lacerated wounds were unscientific, and as soon as the feet had been cut properly several pairs of hands should be used in overcoming the deformity.

Dr. Starr said that he knew the power of the Grattan osteoclast, but the power was applied with a screw, and the operator could not estimate the amount of force employed. With the instrument presented the degree of force could be readily estimated.

# GENERAL REMARKS ON PAINFUL AFFECTIONS OF THE FEET.

By FRANK E. PECKHAM, M.D.,
PROVIDENCE.

The treatment of painful affections of the feet has been pretty thoroughly elaborated, especially as regards its mechanical aspect. Good orthopedic shoes can now be obtained with very little difficulty in most cities. The gymnastic exercises, which are particularly beneficial, have been demonstrated. Many cases with contracted Achilles tendons can now be markedly improved by gradual stretching with a Shaffer apparatus, and every orthopedic surgeon has his own particular method of mechanically supporting the arch, which is so necessary in a large proportion of the cases.

In the effort to increase the efficiency of treatment by mechanical means the general treatment and the treatment of the patient are often overlooked, and I would now emphasize the other methods which, although mentioned in writings on the subject, are perhaps not given the importance they deserve. There are many cases of flat-foot which still continue to be painful, even after all the measures referred to have been faithfully carried out, and these are the cases which demand something in addition to the routine treatment. A foot that has borne weight all day is hot, tender, and painful, and all motion limited. A few minutes of massage is extremely soothing to such a foot. The pain is relieved, the foot is rendered much more flexible, and the gymnastic work can then be done in comfort. If heat is applied just before the massage the result is even better, and heat alone without massage is of the greatest value just preceding the gymnastic exercises. In hospital cases I have used the hot-air oven in almost every painful case, with very much benefit. It has also been of great value in cases of contracted Achilles tendons where gradual stretching was done, the tendon yielding much more and

much easier after an hour in the hot-air oven. With patients in private practice, to save expense, I have substituted a pail of hot water for the dry heat, with very good results. I would say also that the massage in no case has been done by a professional, but either by the patient himself or by some member of the household who has been taught to do it.

One word regarding gymnastic work. The tip-toe exercise is recommended in about every orthopedic work printed, and when in the acute stage of flat-foot I attempted this exercise. When the patient goes upward on the toes, and when he is letting himself down again, the pain and tenderness are increased and the pronation aggravated. The exercises which were most beneficial to me, and which have given the most satisfaction in practice, are those recommended by Dr. Whitman, and they are better done with the patient sitting and the legs resting across a chair or stool.

In a varied practice many cases present themselves which refuse to yield to any of the above methods, and then the physician is compelled to tax his resources. Several cases like the following have presented themselves:

Case I.—A man of middle life, compelled to be on his feet all day and every day, began to have some pain referred to the arch and dorsum of the foot. This became more and more troublesome, until he finally sought advice. The patient was a pretty stout man, the arches were somewhat flattened, and a slight amount of pronation was present. Motion in flexion and extension was normal, but the inversion was slightly limited. A diagnosis of mild flat-foot was made, and the treatment consisted of orthopedic shoes, supports for the arches, heat to be applied every night, followed immediately by gymnastic work. At first it was thought there was some improvement; but apparently, after getting used to the treatment, he could not make out any alleviation of symptoms, and thought, if anything, they were getting worse. The pain was extending up the leg, and was very much worse at night, interfering with his sleep quite a little.

Specific disease was denied, but after some time spent in "fussing" with mechanical supports antispecific (mixed) treatment was begun. There was a marked improvement in the first week, and at the end of a month he considered himself very much better and discarded

the mechanical supports. The orthopedic shoes were discontinued after the single pair, and the gymnastic exercises, I am afraid, were very much slighted, but he continued to take the medicine quite faithfully for about six months, when he ceased to report. At that time there was no trouble whatever, and he considered himself well.

Case II.—A girl, about fourteen or fifteen years of age, who had been working in the mill very steadily until her feet became so painful that she gave up her work and sought medical advice. There was some flattening of the arch and some slight pronation. The pain was referred to the dorsum and extended down to the third and fourth toes. Pressure revealed tenderness along the dorsum of the foot and over the ends of the metatarsals. The pain in this case was much worse at night, interfering with sleep. No history of specific disease obtainable and none suspected. This patient was sent into the hospital, and the treatment was absolute rest in bed, daily hot-air baths, and gymnastic work. There was very little improvement in the symptoms, even after two or three weeks. As in the other case, specific (mixed) treatment was then begun, with immediate improvement. She was gotten up, with orthopedic shoes applied and exercises continued, but the important thing was the Hg and Kl. She ceased to report after three or four months, but at that time was apparently all right.

There is another class of cases in which I have only seen three:

Case I.—A man, past fifty years of age, was referred to me for hot-air treatment on account of a very painful foot. Examination revealed a fairly good arch. Motion in all four directions could be made, but it caused some pain, referred to the dorsum of the foot, extending down to the third and fourth toes. At times it would extend up the leg. The foot was tender to the touch, and he was already wearing very wide shoes, so that they would not press on the foot anywhere. Flat-foot was excluded, but it was impossible to completely exclude metatarsalgia. There was no rheumatic history, and specific disease was denied. As he was sent to me to be baked I gave him a hot-air bath, which did not seem to do him any particular good. Two or three days later, when he returned, he

told me that he was very thirsty most of the time and drank large quantities of water, and consequently passed a great deal of urine. An examination of the urine then and there showed a large amount of sugar present. It is needless to say he did not get a second hot-air bath. A year or more later I heard from one of his neighbors that the two toes affected gradually turned black and dropped off.

Case II.—A man of about thirty or thirty-five years of age, a weaver, came to the out-patient department of the Rhode Island Hospital, complaining of painful feet. He was of necessity on his feet all day. Examination revealed no especial flattening of the arch, and all motions were good. On questioning he acknowledged being thirsty and drinking a great deal of water. The urine showed a large amount of sugar. This patient was referred to the medical department, and never returned for further treatment.

Case III.—A woman, about thirty-eight years of age, consulted me on account of painful feet. The feet were so tender she was practically unable to wear shoes. There was no particular area to which pain was referred, but rather there was a condition of tenderness all over the foot, which was very much aggravated by contact with shoe or stocking. Although the arch was not as high perhaps as the average, yet no especial flattening was made out. Further questioning showed that this patient was drinking large quantities of water, was passing large amounts of urine, and was rapidly losing flesh. It was found also that large quantities of sugar were being ingested daily, a tablespoonful being used to sweeten each cup of tea, and many cups taken every day. In many other ways also an enormous amount of sugar was used. Examination of the urine showed it to be heavily laden with sugar. No treatment was directed to the painful feet, but the ingestion of sugar was stopped in every possible way, the appropriate remedies prescribed, and a marked improvement in the foot symptoms as well as other general symptoms followed almost immediately.

## DISCUSSION.

Dr. Whitman said that the tip-toe exercise was not intended to be used when the feet were very painful. If pronation were increased by the tip-toe exercise it was not given properly, for the feet should be turned in before the body is raised.

Dr. Wilson thought this paper would be of service in training-schools for nurses, for it had been his experience that nurses when first beginning training suffer terribly from painful feet. Moreover, the painful condition does not subside with continuous use. It would seem, therefore, that the continuous exercises were rather exercises of exhaustion than of gymnastics for co-ordination of the muscles of the entire foot. He had not observed especially the connection of painful feet with sugar in the urine, but the great majority of the cases he had seen had suffered intensely during their probationary period. Nearly all of them had obtained entire relief from gymnastic culture, following a line indicated by Dr. Whitman, and the use of heat had only in a very few cases materially altered the condition. In the worst cases the treatment by rest only had been employed. It had occurred to him that it might be expedient for these nurses to have a week or ten days for preparation for their work, including the furnishing of proper shoes.

Dr. Lovett said that for six or seven years he had had charge of all the nurses entering the Boston City Hospital, where from 125 to 140 are on duty. He prescribes a pair of boots for them on general principles. This alone had improved the conditions, but had not been enough to prevent breaking down in a certain number of cases. These cases were very apt to follow attacks of diphtheria, tonsillitis, typhoid fever, or scarlet fever. His experience had been that they would not say much about it at the beginning, and would let it go until they had a tender spot under the heel and a little tenderness under the scaphoid joint. He found it of no advantage to keep those nurses around. They were taken off duty at once and put to bed for a few days. They were given hot air and massage, and were not allowed to return to duty until all sensitiveness had disappeared

from the heel and the foot. He had seen two or three cases in which the symptoms had begun in the foot, apparently a plain flat-foot, and the patient had developed acute articular rheumatism within two weeks. He had examined about 400 nurses, and had seen a few of them leave the school because of intractable irritability of the foot, the cases proving obstinate under the best conditions. The hours at the hospital are extremely hard, the nurses working from seven in the morning until eight at night; in addition, the air is bad and the work hard. After this long experience he would be unwilling to say what nurses would last and what ones would break down, although he thought a few years ago that he understood this. Some of the nurses with the weakest feet and poorest arches last the best, while those with well-shaped feet and the best circulation often give out soon. The solution of the problem was probably to be found in putting the probationers on a course of gymnastics. He thought it would be well to work the probationers on half-time for two weeks until they had become accustomed to the work, and give them at the same time a course of gymnastics, as this would probably prevent many of these women from breaking down. He attached much importance to the muscular condition and general weakness.

Dr. Ridlon said that he had had practically the same experience with the nurses coming under his care at St. Luke's Hospital, Chicago. He was satisfied that a considerable number of them owe a good deal of tenderness of the feet to the so-called rheumatic tendency—apparently an autotoxæmia. They are relieved entirely by a dose of freshly-made senna tea taken every night for two weeks or two months, and repeated whenever there is any tenderness. The infusion should be made fresh, and the dose sufficient to secure a good movement of the bowel daily.

Dr. Compton Reily thought much of this was dependent upon the kind of shoes worn by the nurses when first coming to the hospital. They often wear soft-soled shoes, with heels not as high as they have been accustomed to wear. This caused a stretching of the muscles and tendons of the sole. He had noticed, while a hospital interne, that the physicians wearing soft-soled shoes complained of tender feet, while those who wore heavy soles did not feel this tenderness.

Dr. Baldwin, of Salt Lake City, said that the Sister nurses usually wear better shoes, and hence they did not complain so much of tender feet. He had been using a brace made out of wood for supporting the arch of the foot where it was flat. Each brace was made for the particular case in hand. He had tried antisyphilitic and antirheumatic treatment in addition to the brace treatment, and still found cases that would not yield. A large, heavy girl of twenty while wearing his wooden brace could walk without a limp, but could not stand for even a short time without extreme pain. He would like to know what more could be done for such a case. She had been on antirheumatic and other medicinal treatment for a year or two.

Dr. Weigel said that he had endeavored to bring out at the last meeting the fact that the etiology of flat-foot was perhaps still an unsolved problem. He had presented thirty or more radiographs of painful feet, showing an extreme amount of variation in the anatomical conditions of the foot, and had called particular attention to the class of cases in which there are great pain and only a very moderate amount of flattening of the arch. He had also called attention to the set of symptoms generally called rheumatic, and which disappear when the condition of the foot is relieved. In addition to the mechanical support, he had been in the habit of using static electricity, which certainly produces a very marked beneficial effect on these painful feet where support alone does not give the desired relief. This whole question of painful flat-foot and its permanent relief could be summed up in the statement that it is a matter of correct diagnosis and the selection of the treatment appropriate for the individual case. Pain in the feet may be due to a variety of causes and cannot be treated empirically.

Dr. Starr said that he had had a good deal of difficulty with the nurses in the General Hospital of Toronto, and he wished to ask if it were possible to get one series of lasts upon which shoes could be made for nurses which would give a good result. He had tried this, but had been disappointed in the result. He had done better by having individual lasts made, but it was expensive. In the so-called rheumatic conditions it was probable that there is a partial disloca-

tion of a number of joints of the tarsus, and with this a more or less marked inflammatory condition. The so-called rheumatism might be merely this inflammation or an infection of the inflamed parts.

Dr. Lovett said that he had had this experience with a last made according to his directions, giving sufficient breadth, a straight inner edge, a stiff shank, and a rubber heel. These were now kept in stock in Boston under the name of "orthopedic shoe." Such a shoe costs five or six dollars. He had used them for six or seven years in the hospital, and they had done very well. His mistake at first had been to adduct the shoe a little too much, causing too much exertion on the part of the foot. He had had one epidemic of trouble coincident with overwork after the Spanish war, but also coincident with the use of a stiffer shank, and he was not sure about the advisability of having the shank very stiff. A steel is put in the shank.

Dr. Whitman said that the etiology of the weak foot was not apparently as mysterious to him as to some others; it did not seem to him remarkable that a person who had become debilitated from any cause should present symptoms of discomfort in the feet, since a weak person usually assumes an attitude that subjects the feet to increased strain; in fact, he believed that weak feet might be induced by the habitual assumption of improper attitudes. The wooden support presented seemed to him bad in principle, for it was designed to support the arch simply by forcing the foot to rest on a raised surface. The important symptom of the weak foot was the bulging on the inner side, and this was not affected by this wooden pad or by similar braces. A person with diabetes or with rheumatism who suffered from pain in the feet when standing or walking might with advantage be treated with appropriate support. The final cure of a weak foot depended upon regaining all of the normal movements of the foot and the normal attitudes and postures. A very large proportion of these painful and broken-down feet could be cured.

Dr. Wilson said he did not know whether it was simply coincidental or not, but he had felt that it was improper to splint the feet in any way when employing gymnastics for the feet. He had, there-

fore, insisted upon nurses wearing half shoes, and he would like to hear if Dr. Peckham had had any experience in this line.

Dr. R. T. Taylor said that in cases of persistent flat-foot the forcible placing of the foot in the equino-varus position would not always relieve the symptoms, even after putting them in plaster for several weeks, supplemented by subsequent daily baking and forcible stretching, as suggested by Whitman. He thought it was important to divide the peronei also in such cases, as these were often the cause of the malposition. It is just as unsurgical to try to stretch these as a short tendo Achillis.

Dr. G. G. Davis said he wished to substantiate the remarks of the last speaker in regard to the spasm of the peronei muscles. His old preceptor, Dr. Goodman, used to tenotomize very freely to relieve this spasm. In treating spasmodic flat-foot the patient may be placed in bed, forcible massage employed, and the foot put up in plaster-of-Paris in extreme adduction. When the spasm had been relieved by these measures the next step was to get them up. The use of a pad or flat-foot plate was sometimes all that was necessary, but in the more severe cases he would be inclined to raise the inner edge of the foot so as to throw the weight on the outer edge. He did not think the sole plate always did this, particularly if the shoe were so soft as not to retain the shape. Still, greater benefit would follow the use of a side-iron—in other words, a metal under-sole and a side-iron to keep the sole at the angle at which it is set by the wrench. This, with a specially made shoe, would give extreme adduction, and transfer the weight of the foot to the outer edge.

Dr. Clayton, of Brooklyn, said that two months ago a case of flat-foot had been referred to him, and he had discovered that the man was suffering from diabetes. In another case, plaster-of-Paris, exercises, and a flat-foot brace had improved the man so much that he had taken a position as a painter, and then his climbing up and down the ladder had accomplished more than the rest of the treatment.

Dr. Whitman suggested that it was not only the equino-varus that was important; in overcorrection the foot must be finally forced

up into a right angle with the leg while in the inverted position. This might necessitate the division of the tendo Achillis, as in a case recently operated upon by him. It was most important to bring the foot up to the right angle in order that the patient might bear weight on the foot in walking while it was in the plaster bandage. If these cases were neglected after the period of overcorrection and fixation in the plaster bandage very little would be accomplished; the most important after-treatment was forcible manual stretching. It was not spasm or retraction of the peronei alone that resisted adduction; every muscle on the front of the foot was involved, and sometimes to a greater degree than the latter group.

Dr. Peckham, in closing, said that the whole point of the paper was to ascertain if those present had not had cases which were intractable under the ordinary methods of treatment. He had picked out, therefore, peculiar cases in which failure had resulted from ordinary methods, and success had been achieved by medicinal means.

# CONGENITAL DISLOCATION OF THE HIP.

By E. H. BRADFORD, M.D.,
BOSTON.

The progress of surgery may be noted by recording the successive problems presented each year for solution.

A decade ago there was much discussion as to the possibility of curing congenital dislocation of the hip. Now that the possibility of a cure is established, the question demanding an answer is as to which of two methods recommended gives the greatest percentage of success.

It may be regarded as established that the chief obstacle to permanent reduction of a congenitally dislocated hip lies in the soft parts and especially in the capsule, which is characteristically altered. Where the capsule is not so altered that the head of the femur can be passed through the narrowed portion of the capsule near the acetabulum, reduction can take place without incision. Where this portion of the capsule is smaller than the head, and with resistant firmness covers the acetabulum already filled with vestiges of the capsule and fibrous tissue, an incision is necessary for complete immediate reduction.

Permanency of the cure depends upon several conditions, namely: that the head be well placed in the actabulum; that the acetabulum be sufficiently deep to hold the head; that no fold of the capsule interpose between the head and the bottom of the acetabulum; that no contracted band of the capsule remain, causing a dislocation if the limb be adducted or extended; that the head be placed in its normal position and kept there sufficiently long for the capsule to be firmly contracted about it, with the re-established muscular tonicity holding the head well in place.

Failures and relapses will be found to be due to a neglect of the above-mentioned essentials; and the frequent occurrence of these difficulties and the best methods of determining and overcoming them are subjects needing further investigation before the operation becomes of easy performance.

The treatment of congenital dislocation of the hip has received a great deal of attention of late, and at the International Medical Congress in Paris a special discussion was devoted to the consideration of this subject.

Lorenz, who has done so much in the development of the so-called bloodless method, justly lays much stress on the importance of the after-treatment. It is especially important that after reduction the head should be held in what he terms the primary position, in order that the tissues may adjust themselves after the violence and trauma necessary to reduction; but it is also essential, after the bloodless reduction, that the limb be placed in such a position that the patient must walk in such a way as to exert pressure by the head of the femur upon the acetabulum without the possibility of slipping from the desired position, thereby enabling the acetabulum to shape itself under use. The first object should be to give the anterior fibrous wall of the capsule a chance to gain in strength and prevent reluxation backward. The secondary position, which avoids hyperextension, is given when the danger of reluxation backward is past, but while it is necessary to shape the acetabulum by use, and in that way prevent a slipping forward of the head. Under these conditions the limb is not kept hyperextended and turned outward, but is slightly flexed and abducted.

Kirmisson claims, and the claim is substantiated by X-ray photographs, that many cases of so-called bloodless reduction are in reality simply forward transposition of the head.

The so-called bloodless reduction is not devoid of danger. Fractures of the femoral neck, epiphyseal separation, fracture of the pubes, gangrene of the thigh, and temporary paralysis of the various sciatic branches have resulted probably from imperfect technique of the surgeon, which increasing experience will make uncommon.

According to Kirmisson's résumé of the cases recorded a year

ago, of the 360 cases of bloodless reduction reported by Lorenz, failure occurred in 15, and of 135 cases recorded by radiograph, only 79 show anatomically satisfactory results.

Out of 54 cases of bloodless reduction in the hands of Hoffa 42 were unilateral cases, of which 4 showed permanent reduction, all having been temporarily successful. In many others there was simply a transposition forward. In the bilateral cases there was no permanent reduction of both hips; in 4 cases permanent reduction on one side took place.

Peterson and Schede have come to the conclusion that the result to be anticipated is a transposition and a cure by amelioration. Hoffa has reported 248 cases of open operation, with 10 deaths; none in the last 132. Of 17 unilateral cases treated with his latest methods 9 cures and 8 transpositions resulted, and in 3 double cases 1 cure and 2 transpositions.[1]

Lorenz, in his own statement before the Paris International Congress of 1900, said that in one-half of the cases under his care for bloodless reduction the anatomical results were poor, though the functional results were good; in other words, an improved position was given the head of the femur. In the other half of the cases the results were satisfactory both anatomically and functionally. In double cases, however, perfect anatomical results are obtained in only a quarter of the cases on both sides; in three-quarters of the cases reluxation has taken place on one or both sides, though in all there has been an improvement.

Hoffa reports that in his last 132 cases of reduction by incision 82 were unilateral and 25 bilateral. In 35 of the 82 the ultimate results were ideal both anatomically and functionally. The patients were definitely cured. In 27 the result was not perfect; the position of the head was either not as complete as was to be desired, or there was some limit of the power of adduction. In no patients under eight years of age has there been ankylosis, but in 6 older patients there has been ankylosis in good position.

Out of 25 bilateral cases Hoffa obtained 14 cures. In 4 the result was good on one side; in 3 an osteotomy was needed to improve the position of one side; in 2 cases operated upon in

[1] Revue d'Orthopedie, 1900, p. 289.

patients two years of age reluxation took place; in no case did bilateral ankylosis take place.[1]

From the facts accumulated by recorded experience it may be seen that a small number of cases of unilateral congenital dislocation of the hip can be permanently cured by the bloodless method through the exercise of ordinary skill; that not more than a half can be so cured, even by the exercise of exceptional skill; that the percentage of cures is less in bilateral cases, but that some improvement in gait can be expected in all cases. It is also shown that by the operative reduction, with incision, three-fourths of the unilateral cases of congenital dislocation can be cured at the ages between three and eight, and one-half of the bilateral cases if treated with the best skill; that in children of these ages stiffness is not to be expected unless suppuration follows, a complication which can be prevented by the exercise of care.

The technique of both the bloodless reduction and the reduction by incision has been determined. Neither operation is severe; both require skill and experience. Reduction by incision requires more than bloodless reduction.

Certain questions need now to be answered to make operative interference more definite in its promise of ultimate success. It is possible to determine whether a fold of the capsule remains between the head (partially reduced by the bloodless method) and the floor of the acetabulum. Is it possible to determine, without incision, the comparative sizes of the opening of the capsule at the mouth of the acetabulum and the head of the femur?

When the head of the femur is reduced into the acetabulum by incision it is always necessary, in order to prevent reluxation, to deepen the acetabulum. This is claimed by Hoffa, and regarded as unnecessary by Lorenz. Is the prolonged after-treatment regarded as necessary by Lorenz, essential? Can measures be satisfactorily employed which will shrink the capsule about the neck of the reduced head, and thereby hold the head in the acetabulum as the cotyloid ligament does in a normal hip? In how many cases is the distortion of the neck so severe as to

[1] Transactions of the Thirteenth International Medical Congress, Paris, 1900, Section Chirurgie de l'Enfance.

need osteotomy for perfect cure? What is the best method of after-treatment, and how long is it necessary to continue it?

These questions can only be answered by the careful investigation of the results of all cases treated.

A group of sixteen cases operated upon since January, 1899, at the Boston Children's Hospital, including a few still under after-treatment, are illustrative. In all the operative method by manipulative reduction was successfully employed; in all but one (a bilateral case still under treatment) incision was afterward performed in the attempt to give greater firmness. The cases range from an age of thirteen to one and one-half years, the extremes being beyond the limits of age when treatment should be, by choice, attempted. In none of these was the operative interference attended by danger or serious inconvenience. In one only—that of a child operated upon shortly after an attack of measles—suppuration followed, instead of healing by first intention; but complete healing without sinus followed in a few weeks in the suppuration case. In all others healing by first intention followed.

In a girl, thirteen years of age, it was found necessary to shape the head of the femur by the removal of a piece of cartilage in order to place it well in the acetabulum. This was also done in one of the early cases, and did not cause stiffness or limitation of motion at the hip; but it necessarily caused slight shortening.

Curetting of the acetabulum was performed in only one case, that of the girl of thirteen years, though in two or three of the smaller children it is a question whether this might not have been advantageous. Where this was done the instrument devised by Doyden for the purpose proved of great efficiency. In all but two instances the capsular constriction over the entrance of the acetabulum (the acetabular hymen) was considerably smaller than the head; in some instances much smaller. In all cases the capsule was abnormally thick. In one case where the head was passed through the capsular neck by manipulation, a cutting operation subsequently performed was unnecessary.

In two of the youngest children (two years and one and one-half years), beginning to walk, the shape of the acetabulum was markedly unformed and gave difficulty in securing the head in place, necessitating especial care in after-treatment.

Of these cases four were operated upon between January and December, 1899; and of these, from actual examination and correspondence, it appears that the correction has remained permanent at the present time, and that both anatomically and functionally a prominent cure has been established. In one a portion of a misshapen head was removed at the operation, and some shortening resulted. The result is not perfect, as the hip is not as strong as the other, and a limp persists. The motion is normal and the functional activity all that can be desired.

The cases were all single. In one an osteotomy was performed to overcome the twist of the neck of the femur. X-ray photographs were taken three months after the operation, but none later.

The remaining eight operated upon since January, 1901, may be regarded as still under after-treatment, and the ultimate result is still undetermined.

In all the hip was reduced first without incision, and then the hip was incised to secure the head firmly in the acetabulum. In one, as has been mentioned—perhaps operated upon too soon after an attack of measles—suppuration followed, and for a few weeks transposition of the head, instead of complete reduction, took place. Some stiffness at present exists; the wound has healed perfectly, and the functional use of the limb is satisfactory; there is not, however, an anatomical cure.

Two of the cases are bilateral, and in one the reduction without incision was performed, and the hip appears to be secure; in the other reduction by incision was performed.

In one case, a child aged thirteen years, an alteration of the shape of the head was necessary. In the child aged one and one-half years, a bilateral case, difficulty was found in keeping the head in the acetabulum after reduction, and a longer after-treatment seems necessary, suggesting that beyond the age of ten and under the age of three, operative interference offers chances for improvement, but not of the best results.

From January, 1900, to June, 1900, four cases were operated upon successfully. Of these the ultimate result is known at present to be anatomically and functionally perfect; in one by actual examination; in two the present condition is reported by letter to be entirely satisfactory; in one, a bilateral case, the ultimate

result is not known, but when last examined, six months after the operation, it appeared that one hip was not firm in the new socket.

The results here mentioned coincide with the conclusions of the observers, viz., that congenital dislocation of the hip is a curable affection; that the necessary operative procedures are not dangerous, but require skill; that the percentage of permanent cures from the reduction without is not as great as that with incision; that careful after-treatment is necessary.

# A NEW PROCEDURE IN THE TREATMENT OF HIP DISEASE.

By E. H. BRADFORD, M.D.,
BOSTON.

Cases of acetabular disease of the hip joint are very puzzling in regard to treatment, especially when of the severe type. That this condition is not an infrequent one is well known from pathological evidence. The following procedure was found of advantage in a single case, and may be useful in other similar cases.

A boy, aged six years, was afflicted with hip disease of a severe type, with great pain, but was partially relieved by treatment. The symptoms increased in several months, and the patient was reduced to the usual condition of emaciation and cachexia. The hip was cut down upon and an attempt made to drain the joint, channelling and curetting, as has been suggested as a remedy in similar cases. The condition became serious, and incision was considered, but on an X-ray examination it was found that the head of the femur was but slightly affected, this affection being in the acetabulum. A Badenheuer excision of the acetabulum, with a high percentage of mortality, or an amputation at the hip joint, seemed the only alternative. It was thought that the following method would be tried, and the head was thrown out of the joint by means of an incision similar to that found for excision. The head of the femur was laid upon the dorsum. A free incision was made, allowing entrance into the acetabulum, which was found perforated. A celluloid drainage of an inch in diameter was made by rolling a celluloid sheet, and this was inserted to sufficient depth to reach the acetabulum. The base of the acetabulum was touched with carbolic crystals and washed off with

alcohol. The whole limb was then done up in a plaster-of-Paris spica, allowing drainage and a position of the limb in that of hip disease in the stage of deformity. The effect was brilliant in its improvement of the boy.

The boy required no opiates, was able to move about without pain immediately, and in a few weeks was able to walk about on crutches. The drainage was kept in for about six months, after which time the plaster was removed and the boy allowed to go about without a plaster spica. The boy is now in the condition of hip disease in the stage of deformity. There is still a sinus from the acetabulum, and it is intended to keep the limb in this position for a year, performing a reduction or a Gant operation after the boy has entirely recovered his strength.

At the time of the operation it was found that the head of the femur was but slightly affected, and the acetabulum was perforated. The ordinary excision, therefore, would have been without benefit. The method employed was a life-saving procedure, and left the boy in the condition of deformity which is seen in severe untreated cases of hip disease, namely, with a slight flexion, abduction, and subluxation. This can be later corrected, and the method is suggested as of use in cases of acetabular disease where no other method is of value. The procedure will be of no value in adults or in older patients. In growing children it is offered as a suggestion of advantage.

If the motto of "Natura Duce" is of value it has been followed with success in this instance.

# FORCED FLEXION AND ADDUCTION IN CASES OF EXTREME SENSITIVENESS OF THE HIP JOINT.

By E. H. BRADFORD, M.D.,
BOSTON.

In one case of acute hip disease with persistent night-cries, at the Children's Hospital, which had lasted without check for several months, various methods had been tried: Incision of the joint, heavy traction as high as fifteen pounds, with lateral traction, fixation with plaster spica, and the usual bed treatment. The objective to all these methods of treatment are manifest, in that it is impossible to absolutely fix the hip joint. It is also absolutely impossble to counteract the spasm of the muscles about the hip joint if it is a case of extreme irritation. This being the case, in the rare instances where the slightest amount of motion excites spasm, it is impossible to prevent the jamming of the head of the femur against the acetabulum, which is the cause of night-cries. Under these circumstances it is evident that the muscles chiefly connected with the spasm should be put out of action by the position of the limb. The child was therefore etherized, and a plaster-of-Paris bandage applied to the limb, with a complete cessation of night-cries. A month later the limb was again put straight, with a recurrence of the night-cries, which were again checked by the same procedure. In a similar case of a child, aged three years, with thirteen night-cries a night, the effect of fixation in a flexed and adducted position of the thigh was equally marked.

The procedure suggests itself, therefore, in such instances of extreme type where other measures fail. In how many instances it will be necessarily advisable, is yet to be determined. The measure is, of course, a temporary one, but seems to be conditioned under certain circumstances, the chief of which are those of extreme sensitiveness and extreme spasms.

# AN APPARATUS FOR CORRECTING THE TORSION IN LATERAL CURVATURE.

By E. H. BRADFORD, M.D.,
BOSTON.

In certain cases of lateral curvature the torsion is the most prominent feature. Although torsion is always present, it is in some cases more to be considered than in others when the subject of treatment presents itself.

Given a scoliotic spine in which this is the case, it is manifestly desirable to untwist the spine as a means of corrective treatment. It will be found, however, that the measures which are at the surgeon's hands for this purpose are not as efficient as is desirable. This fact was well brought out by Wolfstein in his interesting demonstration before the International Medical Congress in Paris, where he also showed the advantage of this method of treatment when carried out thoroughly. It is, therefore, desirable that attempts should be made for the use of such appliances for the correction of torsion as may be most efficient, and the following is offered as an apparatus for this purpose:

The appliance consists of a stool with a revolving seat, having a screw attachment which will stop the revolution at any desired point, and straps for securing the knees of the seated patient. To the back of the stool is affixed an upright rod bent at the top for the attachment of a suspension sling. Moving on this rod, but secured by screw stops, are two small rods, one (with a curved, padded end fitting the back of the neck) to press directly forward; while the other, placed at a right angle to the first, carries two arms—one to press directly forward upon the back at a desired point, and the other, passing around the patient's side to the front of the thorax, bears a plate which may be drawn backward, thus exerting a backward pressure.

Around the back of the patient's neck is a rod, bent to extend along the clavicles for a foot on each side of the shoulders. This rod, secured by straps across the back and under the axilla, gives an arm by which the upper part of the thorax can be twisted in any direction. The patient seated in the stool can be twisted, with the shoulders and pelvis in one direction and the thorax at any desired point in another. If the pelvis needs to be raised on either side, a padded wedge inserted under the buttocks will accomplish that end; and by means of a strap of adjustable length passing behind the buttocks from steel uprights on either side of the seat the patient can be made to sit more or less forward. To the seated patient twisted in any direction can be applied a plaster-of-Paris corset which should include the shoulders, passing over the bent rod. The rod is split in the middle, thus making possible its removal from the hardened corset on cutting the securing straps. The corset can be applied to the patient either seated or suspended, or if the stool is tipped backward the removal of the superimposed weight will elongate the spine sufficiently.

# TENDON AND MUSCLE TRANSFERRENCE AND ARTHRODESIS IN INFANTILE PARALYSIS.

By E. H. BRADFORD, M.D.,
BOSTON.

Although it has been said that as the science of healing advances the two branches of medicine and surgery would become so interwoven as to be practically inseparable, yet it is true that the range of pure surgery, or the handiwork of the art of healing, is increasing day by day. An illustration of this truth can be found in the surgical treatment of the results of anterior poliomyelitis. The two following cases may be cited as illustrative:

A boy, aged six years, was brought for treatment, suffering from the effects of infantile paralysis and showing nearly complete paralysis of the left leg and thigh. There were no contractions; ability to move the toes and slight power of flexing the knee remained. The glutei, the tensor vaginæ muscles, and a portion of the adductor retained some strength, but the quadratus femoris and the controlling muscles of the foot were paralyzed. The case was one demanding mechanical treatment, and an apparatus was furnished with which the boy was able to walk freely without the use of a cane. Without the apparatus locomotion was impossible except with the use of crutches. This condition continued, and the boy grew to manhood, gaining complete freedom in locomotion with the use of the apparatus, but being unable to do anything without his apparatus.

In this case the treatment consisted simply in the selection and application of a properly devised apparatus. With this the con-

dition of infirmity is so far ameliorated that the patient has become a self-supporting wage earner.

In the second case more was accomplished by means of direct surgical intervention.

A boy, aged eight years, was taken with extensive infantile paralysis involving the muscles of the trunk and several muscles in both lower extremities. Recovery took place to a limited extent, but the patient was left with a severe lateral curvature and inability to walk without the use of crutches or two canes. There was a valgus position of the left foot and a varus of the right, with a tendency to equinus. There was inability to extend the right leg at the knee, which dropped when weight was thrown upon it. After a period of the usual treatment of electricity and massage the sartorius muscle was transferred to the tendon of the rectus femoris. In six months the ability to extend the leg had recovered so that no apparatus was needed when weight was thrown upon that limb. The transferrence of one of the tibial tendons to the perineal attachment prevented the tendency to varus, and the boy, at the age of fifteen, is able to walk freely without mechanical appliances to the right limb, but needing in the left foot a slight ankle support.

The third case will illustrate the advantage of more radical surgical intervention. A pauper was brought to one of the hospitals with a complete paralysis of the right lower extremity. No continued treatment by apparatus was feasible, and it was decided to stiffen the knee-joint. This was done by cutting down upon the knee and removing the cartilaginous surfaces of the femur and tibia. Firm union took place, and a few years later the girl was able to obtain her livelihood as a waitress. She needed no apparatus.

The three methods illustrated by these cases—viz., mechanical treatment, muscle and tendon transferrence, and the stiffening of the joint—are methods which demand a combination of considerable skill and judgment in the suitable application of each to individual cases. A consideration of the disease is not here pre-

sented. As is well known, medication is of little value at the later stage of the affection, when the patient is brought to the surgeon in a crippled condition, the problem being the restoration to the patient of as much function of the limb as is possible. This involves the correction of the deformity in some instances which will not be considered here; nor will a description of the various appliances needed for the correction and prevention of deformity be entered upon. This paper is intended to call attention to the value of the application of both tendon and muscle transferrence and arthrodesis in many of the cases of poliomyelitis.

Although the palsies following anterior poliomyelitis vary greatly, in many instances certain muscles retain some power, and this power is capable of development from use and of degeneration in case it is not used.

In the lower extremity in the severest cases all the muscles are affected, including the adductor group and the glutei. Such cases appear to be beyond the aid of operative surgery. Arthrodesis, stiffening of the hip-, knee-, and ankle-joint, suggests itself, but the measure seems to be of questionable value, owing to the clumsy condition in which the limb is left. The application of an apparatus with the aid of a cane appears, in cases of this sort, to be the only resource.

Where, as is more frequently the case, some muscles remain, an advantage can be gained by the employment of the non-paralyzed muscles. The muscles frequently left retaining some power are the sartorius, the adductor group, and the hamstrings. The transferrence of the sartorius to the rectus is a measure which can be done without difficulty. The obstacle met is usually the abnormal position of the sartorius, which is often nearer the hamstring at its lower attachment. A curved incision at the lower end of the femoral will bring to light the attachment of this muscle, which should be entirely freed, brought up, and transplanted into the firm sheath of the extensor cruris. Where the sartorius is found to be weak the outer hamstring or adductor can be detached and brought forward and inserted on the outer side into the fascia and tendon of the extensor cruris. Where the adductor group is completely paralyzed the problem presented is certainly a difficult one. Whether the transferrence of the glutei

can in any way be accomplished to supplement weakened adductors is uncertain, but this is perhaps within the limits of possibility, as is also the shortening of the paralyzed adductors, that they may act as a cord to check extreme abduction. In paralytic disabilities of the knee, where all the muscles are paralyzed, making muscle transferrence impossible, arthrodesis is a method only to be resorted to in cases where no mechanical treatment is possible. That a useful limb can be furnished in this way has been abundantly shown, but the resulting stiff knee can be avoided by a properly constructed apparatus, usually preferable to the annoyance of a stiff knee.

In the paralysis of the muscles controlling the action of the feet the combined employment of arthrodesis and tendon transferrence is of great utility. These paralyses may be grouped as follows:

1. Palsies of all the muscles controlling the movements of the feet.
2. Palsies of the anterior group.
3. Palsies of the anterior group, except the extensor proprius pollicis.
4. Palsies of the peroneal group alone.

Where the muscles are all paralyzed in the front of the foot the tendo Achillis can be split and a portion transferred and attached to the paralyzed peroneus tertius, or to the tibialis anticus, or both. The procedure is not difficult, and is performed by making an oblique incision on the outer side of the leg, securing the tendon of the tibialis anticus and of the peroneus tertius above the anterior annular ligament, following them well up to the muscular origin in the leg. A portion of the tendo Achillis is cut off and passed obliquely forward and stitched to both of the cut tendons.

Where the gastrocnemius is paralyzed several procedures have been recommended—the insertion of the tibialis posticus and one of the peronei, the splicing of the tendo Achillis; all are used. The latter, the shortening of the tendo Achillis, has not proved of as great value as the insertion of either the tibialis posticus or the peroneus brevis.

The success in these undertakings depends not only upon the amount of care in the performance, but also upon the uncertain

quality of the strength of the muscles, which is something which is not to be readily determined before an operation.

In considering the treatment of these paralyses it is necessary to bear in mind the peculiar anatomical condition of the joints of the foot. It will be remembered that in addition to the ankle-joint proper, with an up-and-down movement—*i. e.*, the tibio-astragaloid joint—there is the mid-tarsal or Chopart joint, or the articulation between the astragalus and the scaphoid, the os calcis, and the cuboid, giving a side motion, with a certain amount of obliquity. In addition to this a certain amount of play will be found in the metatarso articulation, particularly in that of the first metatarsal.

Tendon transferrence is of value for the purpose of preventing the dropping of the front of the foot, or where the anterior group of muscles have been weakened. Where either the extensor proprius pollicis, anterior tibial, or the peroneus tertius are unparalyzed they can be transferred to either side, and in that way give power for the raising of the front of the foot. Whether this can be done successfully will depend upon the strength of the muscle and the length of the foot. If any of the muscles of the toes remain paralyzed it is possible to utilize the extensor communis digitorum by uniting a paralyzed anterior tibial or peroneal muscle or muscular fascia to the extensor communis digitorum. In this way in many cases the dropping of the front of the foot can be prevented.

In many of the older cases of this affection distortion develops from the adapted shortening of the soft tissue. Valgus and varus deformities are established, induced at first by the inequality of the strength of the muscles and aggravated by the abnormal strain brought upon the various portions of the bones. Under these conditions simple tendon transferrence is not sufficient to prevent a relapse after a correction, as the transferred tendons are not sufficiently strong to withstand the unusual strain brought upon the foot. Under these circumstances arthrodesis of the mid-tarsal articulation is of special service. No difficulty is met with in this operation. An external incision is made and the articulation between the os calcis and the cuboid laid bare, the peroneal tendons being pulled aside. The cartilaginous surfaces of the os calcis

and the cuboid are removed with a chisel, and if any abnormality in the shape of the bone has taken place this can be removed, as the incision can be enlarged or another incision can be made on the inner side, and the scaphoid and astragalus ankylosed in the same way. This, with proper correction, does not interfere with the up-and-down motion of the foot, but does interfere with the twist which it is desirable to prevent. In cases without muscular strength of any of the muscles of the leg, front or back, an ankylosis between the tibia and the astragalus can be performed; but the advantages of this over a proper appliance is not manifest, and the operation hardly recommends itself for this reason. A partial operation to strengthen the ligaments on either side of the ankle by shortening relaxed ligaments is of advantage.

The percentage of complete success from these different procedures, in a large number of cases, is yet to be accurately determined by further clinical investigation. Where these measures have been carried out benefit is evident in suitable cases; and it is desirable to call attention to the advantage of a combination of arthrodesis and tendon transferrence—*i. e.*, to the employment of one or both, with or without suitable apparatus, in proper cases —and to emphasize the fact that the surgeon has in the management of this disability, difficult of treatment, an opportunity for the employment of surgical judgment, anatomical and physiological knowledge, and the exercise of trained skill, with the expectation that in a large percentage of cases benefit will follow his properly directed efforts.

# COSTUME DEFORMITIES.

By E. H. BRADFORD, M.D.,
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In determining the alterations of the human figure caused by clothing, the investigator is met at the outset by the difficulty of establishing the normal standard of human shape.

The "points" of a dog are more or less arbitrary and dependent upon fashion, which often favors defects. Similarly, but less evidently, in the human figure physical distortions have been depicted as standards of form.

It is said that the artist Botticelli's model was a consumptive; if so, the artist's genius has transmitted a defective type, which, with its characteristic thoracic, pathological faults can be traced through the renaissance to modern art.

What was pardonable in times of medical and anatomical ignorance is an offence in these days of greater knowledge. Physical flaws which could be overlooked in the Florentine Flora seem reprehensible in the modern Diana of Madison Square.

Photographs taken by travellers in savage countries enable the student to study the human form which has never been trammelled by clothing; and this he can compare with the figures of peoples long accustomed to dress. Costume deformities can in this way be determined, and should be distinguished from those caused by occupations, which are not considered here.[1]

The injury to the full shape of the neck which comes from clothing is seen in the long, thin neck, with weak muscles and slight subcutaneous adipose, which results from the binding of the neck by collars, stocks, and neckbands. Among savage women

[1] The distortion from shoes, though in reality a costume deformity, will be left in this article to a separate investigation.

heavy neck ornaments have a similar effect, weakening and checking the normal development of the trapezii and the sternomastoid muscles, and, by limiting the normal fatty tissue, often making the clavicles unduly prominent. This defect is so frequently reproduced in art that it might be looked upon as a type to be admired were it not that it is clearly the result of a lack of normal development.[1]

The injurious effect of clothing upon the shoulders is seen when the full development of the muscles is prevented and the shoulders are pulled forward, producing the common round-shoulder deformity.

The difficulty of preventing the sagging of long stockings has resulted in the use of hose supporters, which exert a strong pull upon the waist and upon the shoulders if the waists are furnished with shoulder-straps, as is usually the case with children.

It is difficult to determine exactly the amount of pull exerted in this way, but it is evidently considerable, as is shown by the need of strong clasps upon the hose supporters. The supporters are usually attached to the stocking when the knee is flexed or the body bent forward, and the mere straightening of the figure causes a strong pull upon the waist and shoulders; and this pull increases and varies with the activity and movements of the child. In corsetted women with full hips this strain is borne upon the pelvis; but in children the pull comes entirely upon the thorax, and is at times too great a strain upon the growing muscles, often causing distortion. Even where hose supporters are not worn the weight of skirts, if buttoned onto a waist, falls either upon the pelvis or the shoulders.

Where the hips are not large and the waist is loose, enough drag comes upon the child's shoulders from weight and friction of the clothes to favor a faulty attitude in weak-muscled children. Such faulty attitudes are also induced in young girls with long and heavy hair which is allowed to hang down the back, either loosely or in a braid; the head is held forward, resembling, though to a

[1] If the necks of the figures in Botticelli's "Prima Vera" be compared with that of the "Muse of Crotona," the marked differences suggest the question of race peculiarity or defective drawing. A study of photographs of savage women proves without question that the classic type seen in antique fresco and classic sculpture is the normal one.

FIG 1.

Modern French statue, showing thin neck and shoulders, weakened thorax, bulging hip and upper thigh and thin lower thigh.

less degree, the position of a person carrying a load upon the back suspended from a forehead band.

The injurious effect of the drag of the clothing upon the upper part of the figure is also seen in the flattening of the chest caused by the pressure of the upper part of a loose waist pulled down by hose supporters attached to the front, and by the weight of the skirts. The loose waist slips down as far as the shoulder-straps

FIG. 2.

Magazine illustration showing exaggerated long, thin neck and shoulders.

will allow, and its upper edge presses upon the sternum, thereby flattening the chest.

The most important injury to the figure from clothing is seen in the trunk, where the effect of corsets is so apparent and well-known that no description is necessary. So much has been written of the evil effects of corsets, and so many healthy women have worn them without serious harm, that the inference is natural that

FIG. 3.

Artist's model, showing weakened thorax and bulging abdomen and buttock.

the injuries supposed to be inflicted by this almost universal part of civilized women's dress is less than is represented. Exaggeration is not argument, and pelvic disorders in women, though too common, are not as universal as the use of corsets. But there is no doubt of the destructive effect of corsets or corset-waists upon the normal shape of the trunk and of the desirability of minimizing this in growing girls.

The use of some form of belt or band about the waist to support a skirt is so common in women of all races that it would seem a necessary part of a skirted dress. The mark of the waist strap is seen even in many Greek statues, where the sculptor, in studying his models, was unable to distinguish the lines of nature from those caused by the pressure of the cestus. In most savage and half-clothed natives also this can be seen, but the injury to their figures is so slight as to need for its recognition attentive examination. Where, however, corsets or stiffened waists have been worn constantly since early youth, the injury to the structure of the subcutaneous tissue, to the strength of the surface muscles, and to the contour of the trunk is so marked as to deserve the term destructive. It is so general that modern art, which prides itself on an imitation of nature and a disregard of convention, having but little opportunity of seeing the female figure undistorted, has developed a distorted type of beauty, which would seem grotesque to an Egyptian or classic sculptor, and which will, it is to be hoped, so seem to future students of art. Defective standards make the development of excellence more difficult.

How far the weakening of the trunk muscles from corset pressure is a cause of slow childbirth among civilized women is a question not pertinent here, but that feeble trunk muscles are a common cause of deformity in growing girls is easily seen. The muscles pressed upon (the rectus abdominis and longissimus dorsi) are all needed in holding the trunk erect, and if any of these are weakened, poise is maintained less by the balance of muscular tension than by the fasciæ and ligaments.

A child with weakened abdominal and back muscles stands with the back more hollowed than is normal, in order to balance the trunk readily. Where the muscles are in proper condition they easily hold any needed attitude, but where they are fatigued

Fig 4.

African female figures, showing trunk and thigh undistorted by clothing; neck somewhat compressed by neck ornament.

FIG. 5.

Samoese woman, with normal neck and shoulders.

FIG. 6.

Torso of Greek statue, with slight girdle mark, but without corset deformity of trunk, distorted hips or thigh.

the superimposed weight causes lordosis or hollow back and a compensating forward curve of the head and shoulders. Where muscular fatigue is added to the other causes of round shoulders—namely, the drag of the skirts and the pull of the hose supporters, it is not strange that in growing children the attitude needs correction.

The school exhibition gymnastic drill is often distressing to the observer who notices the close-collared, waist-bound girls and their round-shouldered, flat-chested deformity, only partly concealed by a hollow-back, erect attitude.

Deformities of the hips and thighs may be attributed in older girls and in women to the effect of corset pressure, which checks the normal adipose of late adolescence, causing an undue deposit at the hips, and giving an unnatural contour to the figure at the waist line.

The upper portion of the thigh also bulges unduly, owing to the tightly worn hose. The rest of the limb becomes thinner than the hips from the relatively diminished amount of subcutaneous fat, and adds to the abnormality of the figure, which is pressed upon at the trunk above, on the limbs below, leaving the hips alone free to the contour-rounding adipose.[1]

The effect of tight round garters at the knee would be undoubtedly injurious if it were usual in active children to maintain considerable pressure. Where this is done a slight garter atrophy results.

That children should be allowed to develop as healthfully and normally as possible—whatever injuries conventionality, occupation, or custom may be allowed to inflict upon adult figures—is unquestionable.

The first step is to determine normal standards and to make such standards known.

The standard furnished by Greek art might be accepted as a model; but, lest it be discarded as antique, its reliability should be reinforced through examination of figures uninjured by clothing, hard labor, or suffering.

[1] This corset distortion is different in shape from steatopygia, seen occasionally among Hottentot women. (Deniker: "Races of Man.")

From investigation it appears that exaggerated fulness of the hips, disproportioned leanness of the legs and lower thighs, the flattened chest, narrow waist, and long neck are costume deformities to be avoided in a healthy civilization which seeks to preserve what nature gives.

The question of the proper clothing of adults is one which may be left to the future gradual improvement of public common-sense, but the proper clothing for children is of present importance. The problem is not an insoluble one, as it has been successfully met in other civilizations.

# PATHOLOGICAL LESIONS IN RHEUMATOID ARTHRITIS.

By C. F. PAINTER, M.D.,
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In presenting this subject a much-disputed field in medicine is at once thrown open for discussion. It is not to be a part of the scope of this paper to separate out on clinical grounds one type from the many which go under this caption, though this would be a comparatively easy task. Neither is it my purpose to invent a new name for an old disease. I will go so far as to say that the term here used is entirely inappropriate for a disease with the reasonably well-established etiology and definite morbid changes presented by the disease described. But nomenclature in medicine has not kept pace with progress in clinical and pathological diagnosis, and an appropriate name must come after proper grounds for giving it have become established beyond peradventure.

That you may know what are the clinical characteristics of the type of disease whose pathology I am to discuss, it will be necessary that you understand my clinical point of view. At the outset, therefore, I will briefly set this forth, and show a few photographs of the gross anatomical lesions of what I shall regard as rheumatoid arthritis, for purposes of description, hoping to show the pathological grounds for this belief later on in this discussion.

I am sure the reason—or at least one of the chief reasons—why so much confusion has existed regarding this subject, and so many pathological lesions as well as clinical phenomena have been hopelessly confounded, is because the clinician and the pathologist have heretofore worked so independently. The clinician, until very recently, has not availed himself of the aid of laboratory methods, and has sought to establish rules for diagnosis on data which would

not bear the test of the microscope. The pathologist, on the other hand, has had sent to him, from time to time, material, almost wholly from autopsy, labelled for him by the clinician, as from a case of rheumatoid disease, and he has most naturally found and described very various lesions manifested by one and the same disease. At other times he has described lesions recognized by one set of clinicians under the head of rheumatoid, while someone else not far away has described, pretty constantly, another set of lesions, but calling them by the same name; as, for example, rheumatic gout, chronic rheumatism, etc.

FIG. 1.

Showing spindle-shaped swelling of finger-joints and enlargement of metacarpophalangeal joints.

To go back, therefore, to our first proposed step, I shall regard rheumatoid arthritis in this paper as represented by a usually—in fact, so far as I know, an invariably—polyarticular disease (Fig. 1), occurring most commonly in young and middle-aged adults, usually women—a disease insidious in its onset and development, brought on by wear and tear, mental as well as physical, producing marked constitutional disturbances, and showing in the affected joints grossly—a typical spindle-shaped swelling appearing at first in the phalangeal joints, marked by synovial distention; no true bony enlargements; decided atrophy of soft parts, as seen in photo-

graphs, and atrophy of interarticular cartilage, with oftentimes osseous erosions, as shown by the X-ray (Fig. 2). I have selected

FIG. 2.

the phalangeal articulations because it is here that we are best able to demonstrate the gross lesions, and it is here also that the

disease is most apt to manifest its earliest articular changes. Precisely similar gross appearances are noted in most cases, sooner or later, in the larger joints; for example, the wrists, elbows, knees, ankles, and tarsus. The hips and shoulders are not exempt, by

Fig. 3.

any means, but their anatomical structure prevents the customary appearances from being noticeable. In point of fact, no joint escapes involvement in the most extreme cases.

In approaching this subject from any side, whether historical,

clinical, or pathological, it becomes necessary to describe another type of disease which could be very easily separated clinically from the above-mentioned one, but which is most intricately mixed up with it in the literature. This disease shall be called, for purposes of description, osteo-arthritis, recognizing the inappropriateness of the nomenclature.

This, like rheumatoid arthritis, has a predilection for attacking the terminal phalanges first, as a rule (Fig. 3). It does not limit its attentions to these by any means, but is much more likely than its companion to be limited to these joints for a long time and eventually select some one large joint, as, for example, the knees, shoulder, or hip. It quite commonly manifests itself in the spine. It is more likely to attack individuals a little beyond the middle period of life, though it is not uncommon in the young adult period.

The limitations imposed by the title prevent my going any further into symptomatology and not at all into etiology, under both of which headings a very clear differentiation could readily be established. The gross anatomical changes one notes are shown well by the accompanying photographs and X-rays, which, I think you will admit, show a decided change from the ones illustrative of the rheumatoid process. There is less atrophy ; no synovial swelling ; the enlargements are bony, and the resultant deformities are caused by the presence of asymmetrical bony overgrowths, and not by cartilaginous undergrowths, laxity of joint capsules, and unequal muscular pull, as in the rheumatoid.

In a disease which presents lesions in so many different tissues as does rheumatoid arthritis it is best studied, perhaps, tissue by tissue. Manifestly, the most obvious lesions, and the ones meriting the most attention, are the joint changes, including the synovial membrane and cartilages. Then, changes in the central and peripheral nervous systems ; changes in the muscles ; changes in the skin and changes in the bones themselves ; and, finally, lesions of the viscera, bloodvessels, and lymphatic glands.

With this brief preliminary outline we are preparing to review the disease as we find its morbid anatomy depicted by previous writers.

Review of the Literature. The literature on the pathology of this disease is scant or voluminous according to your point

of view. If you separate the two diseases cited at the beginning of this article, as you can with great exactness, then the literature is very scanty ; if you regard arthritis deformans as the general term which covers both diseases, then the literature is full of references. Accepting the distinction between the two on clinical grounds, it is an easy task to pick out the one from the other, and that is the chief value of a perusal of this literature since Heberden, Hagarth, and others began to describe these diseases. Even down to 1885 we find large numbers of tuberculous joints being described as " osteo-arthritis." The writings of Garrod, Adams, Eve, Duckworth, Bannatyne, Wohlman, Charcot, Senator, Virchow and others abound in allusions to one phase and another of one or the other of these diseases. The studies which have been made have been almost wholly at autopsies, and therefore more of the osteo-arthritic troubles are reported than of rheumatoid. In short, the literature alone is of no value to the student of the morbid anatomy of this disease. The views of Bannatyne, as representing the English, and of Zeigler, as representing the German view, will alone be cited.

The ground taken by Bannatyne and Wohlman, that there is an acute and a chronic type of this disease, is flatly contradicted by the fact that the gross lesions of the types are almost never seen in the same person, and by the more convincing fact that, where patients are followed along through the progressive course of what is termed the acute stage by the above-mentioned writers, the typical lesions of the acute stage are never observed to merge into the typical lesions of what they are pleased to recognize as the chronic stage. A still further controversion of the position maintained by these authors is being found nowadays in the recognition of the occurrence of the chronic (hypertrophic) form of the disease in young people, probably even in children, without any preceding acute (atrophic) stage. The literature is full of descriptions of the monarticular type of disease which Bannatyne calls rheumatoid, and which bears none of the gross or minute pathological appearances of the acute stage of the disease, which is rarely, if ever, monarticular. The lesions of rheumatoid are never suppurative, yet suppurative joint lesions find their way into the bibliography of the disease as evidences of its inflammatory character. This was done by Morrant Baker as late as 1885.

In Zeigler's *Text-book of Pathology* a classification of the various joint lesions is made as follows :

1. Senile arthritis, under which he includes changes in bone or joint which are accompaniments of old age, and also what he calls arthritis deformans.

2. Traumatic arthritis, under which he includes chronic serous synovitis, or arthritis, and arthritis deformans. The chronic serous synovitis is the condition in which the synovial capsule is distended with this fluid, and the villous arrangement of the synovial membrane undergoes hypertrophy—a condition of hyperæmia in the joint which may pass on to rheumatoid.

3. The infective arthritis includes, of course, all the possible bacterial infections, either directly from without or indirectly from within.

4. Neurogenous arthropathy, including tabetic and syringomyelic joints.

5. Gouty arthropathy.

Under arthritis deformans Zeigler includes both the conditions which are the subject of this discussion, claiming that the essential characteristics of the two diseases, as shown in those two X-rays, are the result of the same process—the atrophy resulting from bone apposition. As I have said, these two types never merge into each other.

Bannatyne claims that there are two stages to the disease, an "acute" and a "chronic;" the acute being the atrophic stage and the chronic being the hypertrophic ; and this view is the one evidently held by Zeigler in what he calls arthritis deformans. Clinically, such a position could not be maintained for a moment, and I do not believe it can pathologically.

To go into detail as to the gross and microscopical pathological appearances :

Case I. (Kelly, Fig. 4.) This is the femur of a young man, aged about twenty-six years, who, for five or six years, has been the subject of rheumatoid disease. The bone is spongy, was loaded with fat, and could be crushed in the fingers easily, and had a very thin cortex. The hip-joint was ankylosed partially, and the excision was done to secure motion and correct position. His-

tologically, the bone trabeculæ are very much attenuated; there are very few osteoblasts. The bone-marrow cells look fairly

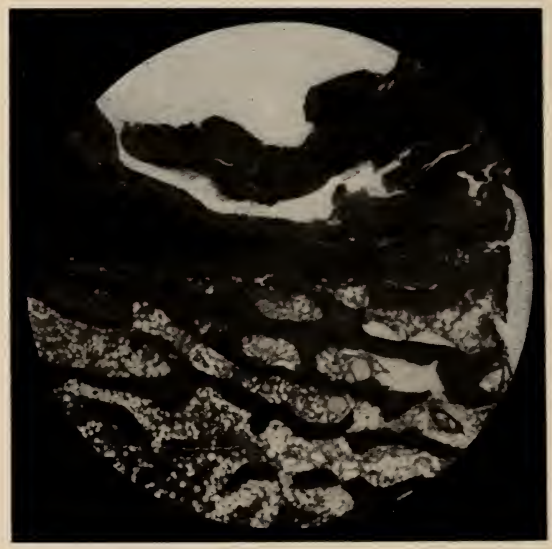
FIG. 4.

FIG. 5.

normal. There is great excess of fat and some excess of blood-vessels in the marrow.

Case II. (Durgin, Figs. 5 and 6.) This patient was a young woman, aged twenty-six years. Both elbows and other joints involved. Excision of one elbow gave this specimen. Grossly, there was very little cartilage left on the face of the condyles of the humerus, over the head of the radius, or on the ulna. Small, grayish islands only, with the bare bone sticking up between. Histologically, there is considerable attenuation of the trabeculæ, fibrillation of the cartilage, and necrosis in places, as is shown by

Fig. 6.

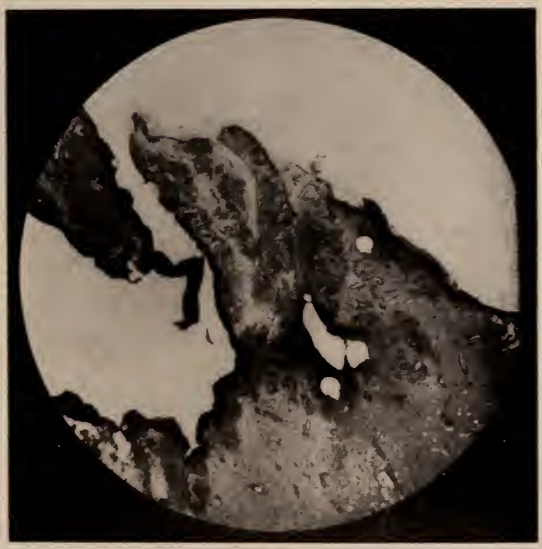


the failure of portions to stain, while other adjacent portions do take the stain and are alive.

Case III. (Danohy, Fig. 7.) A young girl, aged seventeen years. Wrists, knees, hands, and elbows involved. Knee-joints opened and full of fluid, which contains many coagula. Synovial membrane studded with cartilaginous islands from the size of pea to that of thumb nail. Erosions of the cartilage in places and fibrillar appearance in others. Histologically, excess of blood-vessels in the hypertrophied villi and endarteritis of the vessels; fibromyxomatous tissue in abundance, and transformation of this into bone beams and cartilage in many places.

FIG. 7.

FIG. 8.



Case IV. (Hawkins, Fig. 9.) Aged thirty-eight years. Cervical spine, hands, and both knees involved. Both knees opened and drained. Excess of this straw-colored fluid, with a few fibrinous flocculi. Enormous development of villi, which were dark purple in color from congestion. Histologically, a great excess of vessels in these villi; hemorrhages into the tissue; endarteritis in the vessels; infiltration with a chronic inflammatory exudate, consisting of round and plasma cells.

Fig. 9.

Case V. Low power shows a marked proliferation, the tips of the villi being the most cellular, their bases and the connective tissue stroma being quite fatty, with small islands of cells scattered through the fatty tissue. These islands contain some connective tissue and a few round cells, with usually a bloodvessel at the centre of the mass. The villi themselves are very vascular, much more so than normal, and contain very little fat at the tips. The villi are covered on their free edges by a layer of more or less cubical endothelial cells, two or three layers deep.

Under the *high power* the connective tissue is much proliferated. The tips of the villi are infiltrated with round cells, and in the

extremities of the villi are occasional plasma cells. Scattered through the fatty tissue are a few small round cells and numerous thick-walled vessels; in fact, the adventitia of the vessels seems in all cases unusually thick, as though there were a general connective tissue hyperplasia, as in acromegaly.

There are occasional areas of what appear to be a colloid degeneration scattered about through the hyperplastic connective tissue and also not infrequently in the connective tissue seen around the bloodvessels. Very rarely a leucocyte was seen, but they were probably in vessels or extravasated from them, and were not in pathological numbers. Stained for fibrin these sections do not respond.

I have tried to show in the foregoing discussion that this disease cannot logically be claimed to be an inflammatory one, because of the lack of histological elements found at the seat of the lesions in the joints involved which at all compare with the lesion of other inflammatory processes with which the pathologist is familiar. The general character of the disease, distinguished by languor, debility, emaciation—all, however, associated with a lack of pyrexia —must, if inflammatory, controvert all the ideas of inflammation, whether acute or chronic, which we now hold.

Contrast these pictures with the histological appearances in a chronic inflammatory disease, such as osteomyelitis. Chronic osteomyelitis shows a very much denser intertrabecular structure than in rheumatoid. Very numerous osteoblasts about the growing healthy bone, while in the rheumatoid bone the osteoblasts are very rare. The cellular elements in the osteomyelitis are composed of round cells, epithelioid cells, and a few leucocytes; the lacunæ are occupied in the osteomyelitic bone by the nucleus of the bone corpuscles, while in the rheumatoid there is very rarely such a nucleus. No osteoclasts to be seen in the rheumatoid bone, whereas in the osteomyelitic they are very common. There is an increase in bloodvessels in both diseases. A marked attenuation of the trabecula is noted in the rheumatoid bone; little, if any, in the osteomyelitic. The intertrabecular tissue in the rheumatoid is largely fat, very little fibrous base or matrix, whereas in the osteomyelitic there is a dense fibrous base. A very few osteoclasts are to be seen in the rheumatoid bone, and they are frequently

noted about cellular areas in the intertrabecular tissue, where the remains of an old trabeculum are to be seen, which has been taken up by these cells.

Endarteritis shows in the rheumatoid vessels. The foregoing describes the changes as seen in the bones of Kelly as compared with that of a chronic osteomyelitis.

Several other cases, notably the fringe cases from the prerheumatoid stages, show analogous changes in the synovial membrane. A careful search for the organism described by Blaxall in Bannatyne's cases has failed to show the organism.

Now, how interpret these pathological phenomena? There are no lesions described which can be explained upon the ground of any known pathology. The attempts to classify in Zeigler have resulted in confounding several of the stages in the development of rheumatoid, and describing them as separate diseases and not as phases of the same disease. The lesions have more resemblance to those caused by some neurotrophic disturbance or some failure to provide the proper constituents to develop bone and cartilage. On the hypothesis that the cause of rheumatoid is an organism, we have only the disputed evidence of the presence of an organism found in all cases of this disease which have been examined in England. The persons who make this claim bring forward other histological evidence, which does not coincide with any accepted evidence as to the character of inflammatory lesions. Histologically, the case is not proven for a neurotrophic cause, but the histological lesions could be explained on that theory, and all the clinical evidence is overwhelmingly that way.

Taking up the latest exposition of this disease from the English-speaking people, we find that the pathology is treated of systematically under several headings.

In the first place, regarding the bacteriology, when the work done by Bannatyne first came out upon the bacteriology of the disease, I examined the fluid removed aseptically from eight cases of this disease, following the technique exactly as described by the writers above referred to, and through which they claimed not only to have always found an organism with constant morphological characteristics, but they furthermore claimed to have produced

in rabbits and guinea-pigs similar bone and joint lesions, and to have obtained the organism back from the animals. There has been no change in the cultural phenomena of the organism since its discovery in the hands of these observers, but they do not claim the results from animal experimentation which were spoken of in their first enthusiasm. I was unable to obtain any growths from my cultures, and on two occasions since I have turned over the fluid to the bacteriologist with invariably the same result—"no growth." From my point of view it is not necessary, then, to speculate as to how this organism gains entrance to the body or how it gets to the joints. The inflammatory processes with which the pathologist is familiar are associated invariably with repair, and this reparative process begins almost as soon as inflammation itself. Indeed, repair is one of the stages of inflammation. The epithelioid cell is very early seen as a concomitant of inflammation, and the epithelioid cell is the first evidence of repair. We should, therefore, expect to see some such evidence in rheumatoid. This is never the case. One will look in vain for any histological evidence of repair in the osseous lesions of rheumatoid. The "general hardening and thickening of the bones and ligaments" referred to by Bannatyne is an inference and not an observation, for it will not be found to exist either grossly or histologically at any period of the development of rheumatoid lesions. This inference comes from the belief that rheumatoid and osteo-arthritis are the same thing in different stages.

The ulcerations which are referred to as occurring on the cartilage surfaces, and which are so well illustrated in Fig. 6, are erosions of the cartilage, but present no characteristic appearances of an inflammatory nature.

The inflammatory cells on the edge of the erosion, and for some distance back, do not stain, but there is only a very slight round-celled infiltration and no leucocytes present.

To prove the inflammatory nature of this disease one must find from analogy with other inflammatory diseases the objective pathological signs of inflammation. In looking for these gross inflammatory changes, they are found wanting (compare lesions of osteomyelitis); when there is the greatest pain (and many of the worst cases have no pain at any time) there is seldom *acute*

redness or tenderness ; the tissue is pale and becomes glossy and shiny at times ; there is not often very great tenderness, and the effusion in the joint is of such a low grade that it does not raise the surface temperature more than a simple traumatic effusion frequently does. Among the large number of cases of the disease which we have seen at our clinic there has been but one exception to this, and that was the case from whose knee-joint I have shown you some of the synovial membrane. There was a question in this case of tumor albus, and for three weeks the knee was kept in plaster ; at the end of that time I performed an arthrotomy to determine the diagnosis.

In passing it may be worth while to mention the fact that in this case, which was so acute, and which, if the process were inflammatory, either in the cartilage or in the synovial membrane, one would expect adhesions to form, there never has been the slightest tendency. The limitation to the motion in the acute stage of these cases is due to the erosions on the surface of the cartilage, the rubbing of which over each other and over the smooth cartilage gives rise to acute pain and restriction of motion. The condition was present to a marked degree in this case at the time of the exploration. The subsequent history of this case is that of a relaxed joint —so relaxed that, with the leg extended, the patient could not bear any weight on it. The anatomical explanation of this is that the cartilage covering the femur and tibia shrinks or thins, and the capsular ligaments become stretched out as a result of the disease. The capsule is contracted now, or else the cartilage is thickening up again, for the joint is now approaching its normal stability, and she can bear her entire weight on it now unsupported. The motions of the joint have never been limited by an adhesion. Indeed, you would not expect adhesion formation from the character of the tissue changes one observes in the synovial membrane and cartilage. Such changes do take place late in the disease, when contractures have come on and the joints have been for a long time in a position of flexion ; then there are undoubtedly a few postural (if I may so express it) adhesions ; but the main thing is the tightening up of the hamstrings, if it is the knee which is involved. These facts, it seems to me, militate very strongly against the inflammatory

theory, for I believe I am not departing from the facts when I say there is no other disease, which is inflammatory in character, manifesting articular lesions which does not produce firm fibrous adhesions at once in the acute stage. The late adhesions in this disease are sometimes of a different character from what I described. They are dependent upon extensive degenerative erosion of the cartilage, so that cancellated bone comes in contact with cancellated bone, and true bony adhesion then occurs—just what one would expect under any circumstances when you denude two sides of a joint of cartilage, bringing bone in contact with bone.

Bannatyne says that no true bony ankylosis occurs except in the spinal column. Here he is again confusing this disease with osteo-arthritis, or, as he terms it, the chronic stage of rheumatoid.

The history of the pathology of this disease is very interesting. No attempt has been made until Bannatyne's book to solve the problem involved in separating out this disease from medical literature, where so much confusion in nomenclature exists. Apparently in Ireland, from which country Adams makes his reports and observations, osteo-arthritis flourishes more than rheumatoid; consequently his book is full of illustrations of the monarticular, hypertrophic joint disease which is so different from the atrophic condition to be noted in rheumatoid.

The opportunities for pathological investigation have been very few before death in either type. Even at the present time such observations on osteo-arthritis have not been made, so that in attempting to establish rheumatoid as a specific entity, apart from the so-called chronic stage of osteo-arthritis, one has to rely on clinical and gross anatomical facts more than upon histological investigation.

In order to establish the inflammatory origin of rheumatoid one must offer conclusive evidence of the existence of the organism and, in order to be conclusive, it must conform to Koch's law. There are, of course, diseases where bacterial origin is unquestioned because of clinical facts, and analogies with other disease where, perhaps, no organism can be so isolated, and by injection produce the disease in susceptible animals, to be cultivated again from the bodies of such animals. But to establish such an origin beyond a reasonable doubt there must be a strong backing of clinical facts

and analogies. I submit that such has no more been established in the case of rheumatoid than the even probable existence of an organism capable of producing it.

Bannatyne maintains that the bacteria developing locally in the joint manufacture toxins which, thus locally acting, injure the membrane and bones, producing the characteristic lesions. He maintains that he has never seen osteophytes develop in the course of acute rheumatoid, but elsewhere claims that the osteophytic formation in the chronic stage of the disease is due to the effects of this toxin. The interval, as shown clinically, between the development of osteophytes in the chronic state and the manifestations of synovial distention in the acute stage, would imply the maintenance of a virulence in the toxin of this disease almost, if not quite, unknown, and this would be leaving out of consideration the very fundamental clinical fact that these two conditions have never been observed to succeed each other in the sequence above mentioned.

I think that I have shown that the bacterial etiology of this disease, at least in the form that Bannatyne claims, is not proved, and that this point is established by these facts :

1. Failure to satisfactorily demonstrate the organism itself, and the equally significant fact that the lesions found in the joint tissues are not such as are produced by any bacterial cause.

2. That the "chronic" stage in the disease does not present lesions, either gross or histological, which are at all derivative from the "acute" stage, and that therefore we must exclude from rheumatoid classifications any disease with hypertrophic bone lesions.

3. It is suggested, though not proved, that the changes in rheumatoid may be due to faulty metabolism, the absorption from the digestive tract of toxins, or some chemical product of intestinal digestion, which ought not to be thus absorbed, if all tissues were properly performing their functions.

# MULTIPLE PATHOLOGIC DISLOCATIONS: (A) HIP; (B) WRIST.

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While traumatic dislocations are common and pathologic dislocations not rare, yet it is infrequent that we meet with more than a single displacement as the result of disease in the same subject. In using the term pathologic I exclude tubercular joint affections, which, as we well know, unless carefully guarded, induce dislocations, as of hip and knee, but will refer rather to a systemic general disease, as of typhoid and other fevers.

I will show a skiagraph (Fig. 1) of a right hip, displaced on the dorsum ilii, in a boy, aged eight years, also one of a forward displaced wrist in the same subject. (Fig. 2.) At the present time the hip is freely movable, and shows an inch shortening in standing, also slight eversion of the foot. With a high sole his progression is fairly good, so much so that I do not propose to interfere surgically. The wrist is weak and the hand of but little use. (Figs. 3 and 4.) In the way of relief for the affected wrist we may, as an operative procedure, cut away the cartilaginous surfaces and aim to get bony union in a straight position—arthrodesis—or we may inject an irritant into the joint and hope for ankylosis. Before, however, resorting to the severer measures I have thought best to conservatively apply a laced leather brace, which will hold the parts in a corrected position, and so support the wrist that the fingers and hand may be of much use. (Fig. 5.) If this continuous reduction is persevered in, and the wrist never for an instant allowed to become displaced, the ligaments may so shorten as to permanently hold the bones in normal position. At least such will be our expectation.

In regard to the early history of the case, the mother reports that the child had been, up to the time of a severe illness, run-

FIG. 1.

FIG. 2.

ning about and apparently well in every particular. The sickness referred to was attended with high temperature complicated with metastatic mumps, loss of appetite, emaciation, pyæmia, abscesses

FIG. 3.

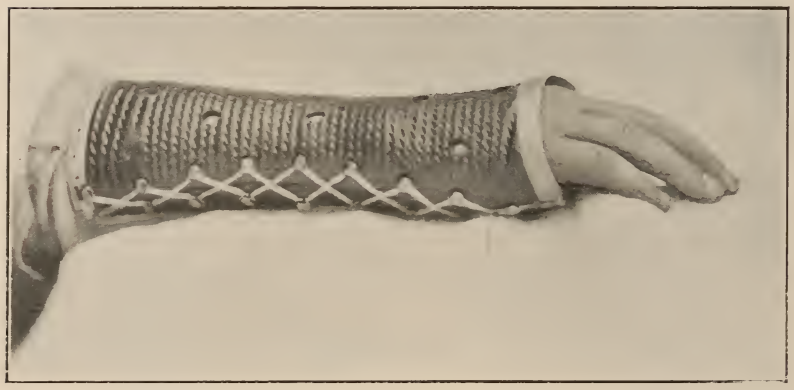
of shoulder, hip, arm, and scalp, and right wrist and arm swollen for three weeks. The child was sick in all three months. When able to be up was observed to limp. The mother says she believed

FIG. 4.

the case was typhoid, and so expressed herself at the time. The case was sent to me three or more years since as one of hip disease, the limb at the time being flexed, adducted, shortened,

and dislocated on the dorsum ilii. As, however, other signs of tubercular coxitis were wanting, and as the history was anything but that of classic hip disease, I doubted the diagnosis; nevertheless, I applied traction for many months until the limb was straight, the head opposite the trochanter, and the ligaments well relaxed. I then adopted the manœuvres of bloodless reduction, and put up the limb in plaster in an abducted position, so retaining it for two or three months, followed with a portable traction splint, and thus I hoped for permanent reduction. But the mother relaxed her efforts, and in an unguarded moment the head slipped out, and has so remained ever since.

Fig. 5.



When the patient was first seen the right wrist was weak, almost flail-like, with constant tendency to forward displacement. Continued use of wrist without support aggravated the deformity and increased the helplessness. Nothing was done for it until recently, when I applied the leather brace above referred to.

Remarks. Though I did not see the case during his acute sickness, and though the early history was somewhat obscure, yet I concluded from what had been gathered, and from the existence of multiple abscesses and joint involvement, that a pyæmia had existed caused by the bacillus. This being true, then, the case is unique, not because of the complicating or sequented abscesses, nor of the multiple arthritis, but because of the existence of

double dislocation, namely, of hip and wrist. Keen, speaking of typhoid complications, tabulates only three cases where joints in both the upper and lower extremities were involved in the same patient; two of which were of the wrist and knee, but none of the wrist and hip. Again, he cites forty-three cases of spontaneous dislocation accompanying or following typhoid fever, all of which were of the hip, except two, which were of the shoulder and one of the knee, but none of the wrist. Again, he does not report a single case of multiple dislocation. Of multiple arthritis, yes; but not of displacement. So our case is exceptionally rare in several particulars.

The complication of typhoid fever with arthritis is produced by the bacilli finding lodgement in the joint, and there causing irritation, with increase of serous fluid, distention of the synovial sac, succulence and elongation of the ligaments, and with a possible dislocation—favored by position and traumatism.

In this connection I might be permitted to report a second case of hip dislocation following fever. The patient, a female, is now twelve years old, and very well with the exception that her left hip is out. The disease producing or leading up to this displacement occurred five years ago. About the case the family physician wrote to me at the time as follows: "It commenced with la grippe and middle-ear suppuration, then with swelling of wrist and ankle, then abscess in right thigh and dislocation of left hip." I did not see the case for some weeks after the above was written, but when it did come under my observation it was pitiable, indeed. Both limbs drawn up, wrist stiff and painful, child anæmic, no appetite, nervous, sleepless, crying, screaming, even at the approach of the doctor. However, by judicious treatment, in due time I had both limbs down, wrist improved, sleep, appetite, and color returned, and much of the time out-of-doors on a stretcher splint in a little buggy. This treatment was suddenly interrupted by a cyclone demolishing the home of the parents, who soon after took up their abode in Chicago and called in Dr. Ridlon, who consented to an attempted reduction of the dislocated hip, under an anæsthetic by Dr. Sam. Weber. I wrote to Dr. Ridlon at the time that I considered it one of those rare cases of multiple abscess and arthritis complicating typhoid fever. Several months later,

the child again coming under my observation, I advised strong traction with abduction for several weeks, then an attempt at reduction by the bloodless method. To this Dr. Gibney, who happily was visiting with me at the time, gave his approval, and suggested I should report the case as one of that rare class of dislocated hip following typhoid. Our suggestions were not

FIG. 6.

adopted by the family, who again moved to Chicago, and I lost sight of the case, though I understand the patient at present is quite well, but with a displaced though very serviceable hip.

Here, again, was a second case of wrist and hip arthritis complicating typhoid, and, additionally, a hip dislocation, and, further still, abscess accompaniment.

I may be permitted to relate a third case of hip involvement following fever, in the person of a lad who came to me from Arkansas, with dislocation of the right hip and ankylosis in a flexed and adducted position of the left hip.

Fig. 7.

It can be readily understood how labored must have been his efforts at locomotion. Photograph shows the deformity. (Figs. 6 and 8.) I did a subtrochanteric osteotomy on the ankylosed thigh, greatly to his relief, as seen in Figs. 7 and 9. Of his early

history I learned that complicating a high and continuous fever both hips were affected and drawn up. After recovery one hip was found to be out and the other one fixed in flexed position, in which condition I found him.

FIG. 8.

SUMMARY. 1. Three cases of multiple arthritis following fever.

2. Two cases of wrist and hip arthritis.

3. One case of double hip arthritis.

4. Three cases of hip dislocation following or complicating fever.

5. One case of multiple dislocation—*i. e.*, of wrist and hip.

I may close with the practical suggestion that physicians treat-

ing typhoid fever should remember the possibility of joint complication, arthritis and bony displacement, and when such are

FIG. 9.

present be prepared to support the inflamed joint, which, if of the hip, keep extended to guard against dislocation.

# ON RESISTANCE EXERCISES IN THE TREATMENT OF DEFORMITIES OF THE FEET AND ANKLES.

By E. MUIRHEAD LITTLE, F.R.C.S.,
LONDON.

By resistance exercises I understand the use of repeated movements of a part of the body in which a definite resistance has to be overcome, the object being to strengthen those muscles which effect the movements. There is nothing new in the principle in these exercises, for in some sense all gymnastics may be considered to be resistance exercises, whether the resistance be the weight of the body, or that of clubs, or dumb-bells, etc., or the elastic cords of various "exercisers."

In the Nauheim treatment of heart disease the resistance employed is the pressure of the attendant's hands. There are various deformities of the foot and ankle in the treatment of which exercises are of value.

In flat-foot and in-ankle (or overpronated foot) it is considered desirable to strengthen the adductors and external rotators of the foot, together with those muscles which in the normal foot support and help to maintain the plantar arch. With this object tiptoe exercises are often prescribed and also exercises in which the above-named muscles are more definitely employed in overcoming the resistance offered by the hand of the nurse or attendant.

For this purpose the patient should be seated in a chair, with the knees fully extended and the ankle also extended (plantar flexed). The nurse sits or kneels near the inner side of the limb and steadies it with one hand, which grasps it below the knee, while the other hand grasps the forepart of the foot and gently presses it outward and at the same time rotates it inward to a

slight extent. The patient then tries to overcome the pressure of the nurse's hands and to adduct and rotate out the foot.

Many patients are so unaccustomed to consciously direct the movements of their feet that they have to be taught to move the feet in the required direction without opposition at first. When the opposition is applied it should be just as much as the patient can overcome completely. It needs some practice on the nurse's part to apply the right amount of force in the required directions.

Fig. 1.

In the photograph (Fig. 1) the foot is represented in the position of adduction and rotation outward, the movement having been just completed.

In case of club-foot the abductors and internal rotators (peronei and common extensors of the toes) may be strengthened by an exercise the exact converse of that just described.

The exercises which are intended to strengthen the extensors (plantar flexors) in talipes calcaneus or the flexors (dorsi-flexors) of the ankle, in talipes equinus, are simple enough.

The patient's knee being, as before, extended, the nurse is to seat

herself facing the sole of the foot, and steadying the leg with one hand grasps the forepart of the foot with the other and opposes the desired movement. In every case the exercise should be begun with the foot in a position as far as possible the opposite of that into which it is to move against the resistance. Thus, in a case of flat-foot the movement should start from the deformed position of the foot.

In paralytic deformities resistance exercises are only of use when the weaker muscles are not entirely paralyzed, but after operations

Fig. 2.

of tendon transferrence they are of great value; at first to supplement, and later on to supersede faradic stimulation of the newly arranged muscle or muscles.

The repeated performance of its physiological function stimulates the development of a muscle far more than can any electrical stimulus.

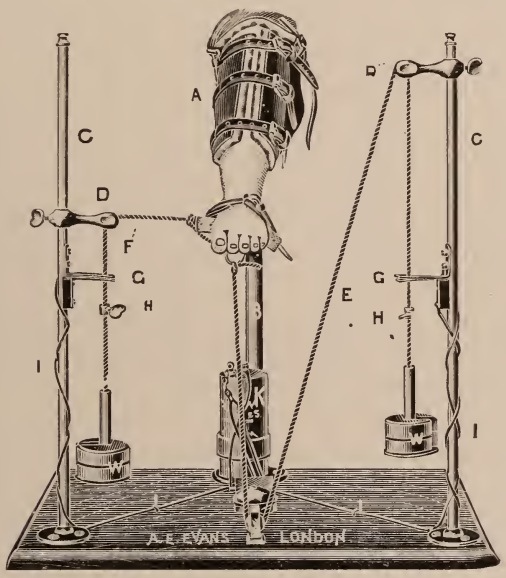
Simple as the exercises so far described are, it often happens that patients and nurses cannot or will not carry them out, and harm instead of good will result if the nurse simply pushes the

foot into the deformed position instead of just offering opposition to movements of rectification.

It is therefore better in many cases, and especially in young children, to substitute the resistance of a small weight for that of the nurse's hand.

This may be simply hung upon the forepart of the foot by a strap or loop of bandage, the patient being first turned on one side or the other, or on his face or back, as may be necessary, so that the movement of rectification may lift the weight.

Fig. 3.




It is, however, more convenient to attach the weight to a cord running over a pulley, such as is commonly used in hospitals for applying weight extension in cases of fracture or joint disease.

The photograph (Fig. 2) shows this method in use to strengthen the calf muscles as in a case of Nicoladoni's operation.

A more convenient means of applying exercises with weights is the apparatus which was described by me briefly in the *Lancet* (London, April 6, 1901), and which is represented in the annexed figure (Fig. 3).

It is suitable for cases of talipes varus, valgus, equinus or calcaneus, and for either foot. The weight and pulley arrangement that is used for varus of one foot is to be used for valgus of the other.

It consists of a strong board to which are screwed three uprights of iron gas-pipe. The shortest and stoutest of these (*B* in the figure) is fixed at the middle of the hinder edge of the board, and carries a padded trough, *A*, consisting of a thigh-piece and a leg-piece, fixed at about a right angle to one another.

The patient, being seated in a chair of a convenient height, has the affected limb firmly strapped into the trough, with the knee necessarily bent, but the foot and ankle hanging free. The bent position of the knee is necessary to prevent rotation at the hip-joint, which movements patients are apt to substitute for true adduction and abduction of the foot.

Two much slighter but higher side pillars, *C*, *C*, are screwed to the two front corners of the board. Each of these carries a short arm with a pulley at its free end, *D*, *D*. This arm and pulley can be shifted up and down and rotated around the axis of the pillar and fixed in the desired position by a set thumb-screw.

Over each pulley a cord passes, one end of which is attached to a weight-holder and the other to a strap which goes around the forepart of the patient's foot.

When it is intended to strengthen the adductor muscles of the foot (as in valgus) the cord on the outer side of the foot is alone used, but when it is necessary to strengthen the abductors the cord on the inner side of the foot is employed.

A third pulley fixed to the middle of the front of the board is used when it is desired to strengthen the dorsi-flexor muscles (extensores digitorum, tibialis anticus, etc.), as in cases of talipes equinus.

A longer cord, as shown at *E*, is then required, as its direction is twice changed when it passes over the two pulleys.

In cases of talipes calcaneus, or when for any reason it is desired to strengthen the plantar flexor muscles (gastrocnemius, soleus, etc.), both pulleys are raised to the top of the pillars and both cords are hooked on to the toe-strap and both weights are used at once, but the middle pulley on the baseboard is not used.

Intelligent children of ten years and upward will generally use this apparatus with a little supervision without any difficulty; but younger children often find the pushing away of a nurse's hand or the frequent lifting of a weight by the toes uninteresting, and it is consequently difficult to get them to perform resistance exercises of any kind.

This difficulty has led me to add the dry cell (*K*) and common electric bell, which will ring whenever the weight is lifted to the desired height and will continue ringing as long as it is kept at that height by the muscular action of the child.

This is effected by the following arrangement:

*G*, *G* are contact makers, consisting of two plates or leaves of brass fixed close together, one above the other, but insulated from one another. The upper leaf is rigid, but the lower one is a weak brass spring.

There are corresponding holes in these two leaves through which the cord of the exerciser passes freely.

Each of these contact makers, *G*, *G*, forms part of an insulated wire circuit which includes the bell and battery. (The wires are seen at *I*, *I*, *I*, *I*.) A block, *H*, too large to pass through the holes in the contact maker, can be fixed by a screw at any part of the cord. When the weight is lifted far enough this block presses the lower leaf of the contact maker against the upper, and so closes the circuit, whereupon the bell rings and goes on ringing as long as the block is pulled up against the spring leaf. Only one contact maker is to be used at a time.

In the figure the cord *F* is represented as arranged for a case of varus of the left foot, while the cord *E* is arranged for talipes equinus.

As a rule, only one cord is used at a time (except for calcaneus); but if desired a compound movement may be made. For instance, both weights and cords may be used, as arranged in the figure, for talipes equino-varus, but it will generally be found that it is better to work each group of muscles separately.

The apparatus is most useful in flat-foot and congenital talipes, less often so for infantile paralysis, except in the after-treatment of cases of tendon transfer. When made of a proper size it is useful for adults as well as children.

As for the weights to be used, from four to eight ounces are generally enough for small children.

The frequent repetition of a moderate effort will do more to develop muscle than the occasional performance of the greatest effort of which the muscles are capable, which is apt to cause strain and fatigue.

The temptation of making the bell ring and of keeping it ringing at will is one that few children can resist; but in order that they may not tire of the exercise it is essential that they should not be allowed to play with the machine as a toy. Its use should be reserved for stated periods, and be made rather a treat than a task.

# THE QUESTION OF SPINAL BRACES IN LATERAL CURVATURE.

By A. B. JUDSON, M.D.,
NEW YORK CITY.

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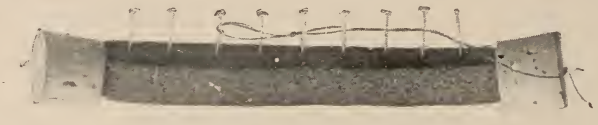
It has been proposed that apparatus having a strong antero-posterior action for the maintenance of lordosis be used, instead of braces which make the customary pressure on the ribs, in lateral curvature of the spine. Experiments in this direction have, however, resulted in nothing notable, and the suggestion has been fruitless, so far as I am aware.[1] It may be that the inconvenience of wearing such a brace is too great in a disease which carries with it no menace to the patient's life and but little to her health and comeliness. It might be argued, but not too seriously, that lateral curvature of the spine is an attractive feature, falling in the same category as a slight cast or squint, which has been thought to add piquancy to the beauty of a pretty face. It cannot be denied that the typical sigmoid curvature reproduces the technical curved line of beauty, or that the accompanying rotation carries with it an expression of serpentine or sinuous grace.

It is true that in rare instances the rotation is so extreme that the kyphos rivals that of an ill-treated case of Pott's disease. As a rule, however, the deformity is not conspicuous, and we are generally satisfied with the results of treatment which is palliative rather than radical. For some reason or other we do not pursue the treatment of this affection with the earnestness which marks our efforts in club-foot, for instance. If, however, it were necessary to overcome absolutely a lateral curvature it would not be too much to require a patient to wear a steel brace for the production of lordosis for as many years as might be considered necessary in a

[1] Transactions of the New York Academy of Medicine, 1876, p. 330.

growing girl. In Pott's disease the forcible production of lordosis transfers compression from the vertebral bodies to the processes which as a rule are healthy. The same force in lateral curvature produces the same effect, taking superincumbent weight from the bodies which depart from, and putting it on the processes which are held near, the median plane. This provides a mechanical application directed against rotation, which is the most intractable element of the deformity.

FIG. 1.



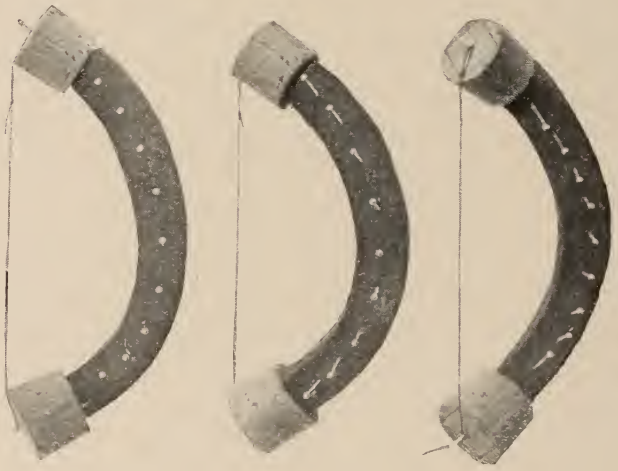


FIG. 2. FIG. 3. FIG. 4.

Such may never be the established treatment, but an appreciation of the mechanics involved makes clear the fact that rotation is produced by the lateral mobility of the anterior section of the column combined with the absence of such mobility in the posterior section.

An interesting contribution to the study of this subject is the suggestion that rotation in lateral curvature may be determined by the flexion or extension of the spine. As an aid in this inquiry

I arranged for photography an imitation of the spine, made of India-rubber (Fig. 1), in order to see whether antero-posterior variation would influence rotation in any way. The middle pin is taken point-blank in each photograph in order to secure the same point of view in each exposure. In Fig. 2 there is a plain lateral curve without flexion or extension. The heads only of the pins are seen, showing the absence of flexion, extension, and rotation. In Fig. 3 a lateral curve is combined with flexion. The latter is shown by the inclination of the pins, and the absence of rotation is demonstrated by the fact that the head only of the middle pin is visible, while the heads of all the pins are found in the middle of the curved column. In Fig. 4 a lateral curve is combined with extension, as is shown by the inclination of the pins. Some rotation is apparent, but this would have disappeared if the object had been placed more carefully before the camera so that only the head of the middle pin had been exposed.

From this it would appear that rotation of the spine is unaffected by its flexion or extension, a result which might have been expected *a priori*, because the curve in any case is but a simple curve and incompetent, as such, to govern rotation. In Figs. 3 and 4 the curve may at the first glance seem to be made up of two curves, a lateral and an antero-posterior one, but further consideration leads to the view that it is a simple curve, produced by the resultant of two forces, one acting in an antero-posterior and the other in a lateral plane, and as such it has no more power over rotation than any other simple curve.

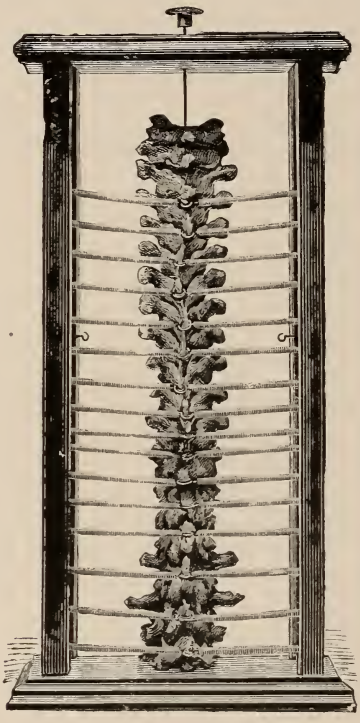
It may be said that any rod or flexible column cannot, of itself, rotate when curved. The spine, however, is a flexible column, a part of which, made up of the vertebral bodies, has wide lateral displacement (or has extra flexibility) in the cavity of the trunk, while another part, composed of the processes, is prevented from lateral displacement (or has less flexibility) from being a constituent part of the wall of the cavity. It therefore rotates when curved. This view was presented by Mr. Charles H. Rogers-Harrison in 1842.[1] The mechanics of spinal rotation thus described in words is shown in the common preparation of the vertebral

[1] Deformities of the Spine and Chest, London, pp. 93, 94.

column, Figs. 5 and 6, in which the processes are held near the median plane by a succession of spiral wire springs, while the bodies, swinging away from the median plane, exhibit rotation.

The application of posterior pressure is demanded by the mechanics of the deformity which, on the other hand, furnish no warrant for the use of a brace making lateral pressure on the ribs.

Fig. 5.

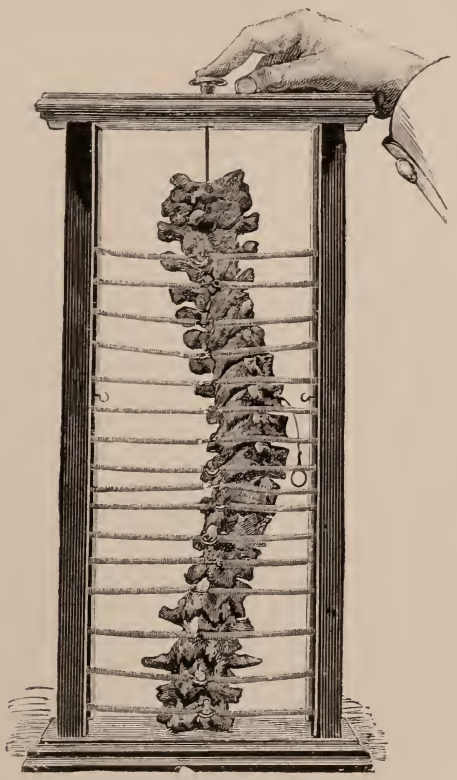


Such a brace may promote comfort and conceal asymmetry, but if it is applied with force it will add to the deformity. As the ribs spring from the posterior section of the column, pressure on them will push the spinous processes still further toward the concavity, and thus increase the rotation, as was pointed out by Mr. Andrew Dods in 1824.[1] The difficulty may be readily appreciated by

[1] The Rotated or Contorted Spine, London, pp. 226, 227.

imagining the effect of lateral pressure made directly on the vertebral bodies without the intervention of the ribs. The effect of such an application, impossible as yet, would be to combat, by one

Fig. 6.



motion, both the lateral curvature and the rotation, at once correcting the deformity in simple cases in which structural changes were absent.

# PRIMARY SARCOMA OF THE SPINE.

By JAMES K. YOUNG, M.D.,
PHILADELPHIA.

The following case is recorded as a contribution to the subject of primary sarcoma of the spine, being part of a paper published in the *University of Pennsylvania Medical Bulletin*, April, 1901.

The writer has observed three cases of secondary sarcoma, but the case reported below, of primary sarcoma, is the only one which has been met with in an experience of twenty years.

L. L, male, aged five years, Russian Hebrew, was admitted to my children's ward at the Polyclinic Hospital, April 13, 1899. The patient's history was very imperfect, as the family spoke very little English. They denied that the child ever had any weakness or deformity prior to a fortnight before, when he fell from a table and struck his back. From the time of this injury he was unable to move his bowels, though the desire to do so was intense, and there was also incontinence of urine. A previous history of severe measles and of whooping-cough was obtained.

On admission the patient was unable to straighten the trunk, and complained of pain in the lumbar region. No projection of the vertebræ could be detected. Flexion of the spine was due to spasm of the psoas muscles. The hip-joints showed limitation in forced extension, but were otherwise normal. Incontinence of urine and feces. A diagnosis of incipient Pott's disease, involving the entire lumbar region, was made. The patient was placed in a metal cuirass, with head and foot extension, and pressure was applied by small sand-bags in the lumbar region. In one week he was greatly improved, could lie flat on his back, and there was marked improvement in the symptoms of incontinence. At the end of a fortnight he was discharged, all the symptoms being

greatly improved, and a plaster-of-Paris jacket holding the trunk straight.

The patient was readmitted June 6, 1899, for the fitting of a brace. Constitutional remedies, cod-liver oil and hypophosphites, were administered, and ten days later he was sent to a Seashore Home.

FIG. 1.

Sarcoma of spine. Showing deformity.

February 10, 1900, the patient was readmitted for the second time, having grown progressively worse. On admission his temperature was 101.6°, pulse 140, and respiration 28. The urine was alkaline, specific gravity 1022; no albumin or sugar. He was placed in bed with head and foot extension, and, on March 7, 1900, an exophthalmos of the right eye was observed. The lateral movements were slightly restricted, the eye could be pressed in a little by gradual pressure; both pupils reacted evenly and readily

to light. There was no bruit or thrill. Dr. Samuel D. Risley, who examined the eye at this time, could not explain the cause, but suggested an œdema of the tissues in the angle of the orbit. The superficial temporal veins of the same side became greatly engorged, and œdema of the tissues near the external malar process was noted. Five days later a neoplasm of the orbit was diagnosed and œdema of the left lid was noted. Dr. Walter J. Freeman made a thorough nasopharyngeal examination on the following day and discovered a tumor in the external angle of the orbit. The temperature ranged from 98.8° to 100.2°. The eye was almost entirely extruded from the orbit.

On April 12, 1900, Dr. Risley, under ether anæsthesia, removed the protruding eye. A large growth from the temporal region was found filling the orbit, a portion of which was removed for microscopical examination. Dr. Edward H. Shumway, who examined the growth and eyeball, reported as follows: "The small piece of the retro-ocular growth measured 7 x 6 x 5 mm. It is composed chiefly of orbital fat tissue, which shows an infiltration with blood and deeply staining cells. The latter are mononuclear round-cells, the deeply staining nuclei of which occupy the greater part of the cell-body, leaving a narrow rim of protoplasm unstained. There are a few polymorphonuclear leucocytes in the surrounding tissue, but no marked inflammatory reaction. A portion of the central part of the growth would have been more satisfactory, but the presence of the typical lymphoid cells and absence of inflammatory reaction justify a diagnosis of *small round-celled or lymphosarcoma.* The eyeball shows dense infiltration of the cornea with inflammatory cells, extensive ulceration of the surface, and splitting apart of the corneal lamellæ. The episcleral tissues are swollen, œdematous, and hyperæmic, and infiltrated with polymorphonuclear leucocytes. The anterior chamber is nearly filled with similar cells, and the iris and ciliary bodies are likewise so closely crowded with them that their structure is, in places, concealed. The anterior capsule of the lens shows a few pigment clumps, from former synechiæ. The lens is otherwise normal. The vitreous is infiltrated slightly, the inflammatory cells extending backward to the ora serrata. The posterior parts of the retina and choroid are normal. Anteriorly they are moderately infil-

trated. The optic nerve fibres are partially atrophic. There is no trace of tumor within the eye.

FIG. 2.

Sarcoma of spine. Showing disturbance of venous circulation and metastatic growth in orbit.

"Diagnosis. Purulent kerato-iritis, with beginning panophthalmitis. Atrophy of optic nerve, partial."

Considerable hemorrhage occurred during the operation, but reaction was prompt. The growth continued to increase both through the orbit and over the malar region.

May 8, 1900, the left eye began to bulge forward and the superficial temporal veins became very prominent A corneal ulcer appeared and the sight was subsequently lost. About the time the growth appeared in the right orbit the lumbar region of the spine began to project backward in two round masses on either side of the median line. Subsequently this increased in size, the pain increased in the lumbar region, and peripheral neural pain in the right thigh continued, the superficial veins of the abdomen became greatly engorged and the abdomen greatly distended. The emaciation was extreme. Narcotics were required in increasing doses, and the pain both in the lumbar region and in the right thigh was intense. There was distinct dulness in the epigastric and left hypochondriac regions, and the circulation in the superficial veins of the abdomen became reversed, acting as a collateral circulation to the obstructed deep circulation.

The patient gradually failed, and died of asthenia June 5, 1900. No necropsy was permitted.

# CARIES OF THE SPINE: AN ANALYSIS OF ONE THOUSAND CASES.

By J. HILTON WATERMAN, M.D.,
AND
CHARLES H. JAEGER, M.D.,
NEW YORK CITY.

In general those who have collected statistical data in reference to spondylitis have analyzed special symptoms and conditions as they occur in a certain number of cases. It has been our aim to add to the value of those already formulated by collecting a large number of cases and presenting several features of each case.

In this analysis we have taken one thousand consecutive cases from the record-books of the Hospital for the Relief of the Ruptured and Crippled, and for the purpose of convenience and comparison we have arranged the cases into six groups, according to age:

| | |
|---|---|
| The first group, from birth to age | 5 |
| " second group, from 5 " | 10 |
| " third " " 10 " | 15 |
| " fourth " " 15 " | 20 |
| " fifth " " 20 " | 30 |
| " sixth, all those over | 30 |

We then consider the frequency with which spondylitis is present in male or female, the first symptom or symptoms which called the attention of the family to the existence of the disease, and the deformity with reference to its degree, the cause where it could be ascertained, as well as the family antecedents, the occurrence of abscesses during the course of the disease, the presence of paraplegia and of tubercular complications.

In all the statistics available to date it is noted that the age is given at which the patient first applied for treatment. In this analysis we have endeavored to ascertain the age when the disease began, and we have, therefore, noted the duration of the symptoms before the patient applied for treatment.

Sex. In the first five years of life, of 600 patients, 310 were males and 290 were females.

The disproportion between the sexes was found to be greater in the second five years of life; there were 147 males and 113 females.

From ten to fifteen, however, the disease was present in 26 females and in 12 males.

From fifteen to twenty years but little difference is noted; there being 15 males to 13 females affected.

From twenty to thirty years of age 29 males and 13 females had the disease.

Over thirty years there were 22 males and 10 females.

This gives a total of 535 males and 465 females.

It may be difficult to explain the preponderance of females over males in the ages between ten and fifteen, for it is evident that, taken as a whole, the tendency is greater in the male than in the female. In Vulpius' statistics, collected from fifteen authors, a total of 6586 cases, he found 53.25 per cent. occurred among males and 46.75 per cent. among females. Our youngest patient was six months old and the oldest sixty-nine years.

Location of Disease.

| | | Birth to 5 | 5–10 | 10–15 | 15–20 | 20–30 | Over 30 | Total. |
|---|---|---|---|---|---|---|---|---|
| Cervical, | 1 | ... | 1 | ... | ... | ... | ... | 1 |
| " | 2 | 2 | ... | ... | ... | ... | ... | 2 |
| " | 3 | 6 | 8 | ... | ... | ... | ... | 14 |
| " | 4 | 8 | 2 | 2 | ... | ... | ... | 12 |
| " | 5 | 5 | 3 | 1 | ... | ... | ... | 9 |
| " | 6 | 11 | 4 | 1 | ... | ... | ... | 16 |
| " | 7 | 7 | 5 | ... | ... | ... | ... | 12 |
| Dorsal, | 1 | 17 | 3 | ... | 1 | ... | ... | 21 |
| " | 2 | 10 | 4 | ... | ... | ... | ... | 14 |
| " | 3 | 27 | 12 | ... | 1 | ... | ... | 40 |
| " | 4 | 26 | 10 | ... | 1 | 1 | ... | 38 |
| " | 5 | 21 | 11 | 1 | 2 | 1 | 2 | 38 |
| " | 6 | 49 | 18 | ... | 1 | 1 | 1 | 70 |
| " | 7 | 38 | 14 | 2 | 3 | 4 | 1 | 62 |
| " | 8 | 49 | 23 | 2 | 1 | 3 | 3 | 81 |
| " | 9 | 50 | 17 | 7 | 5 | 5 | 2 | 86 |
| " | 10 | 66 | 17 | 2 | 6 | 7 | 8 | 106 |
| " | 11 | 41 | 15 | 1 | 1 | 4 | 3 | 65 |
| " | 12 | 50 | 23 | 4 | 1 | 8 | 2 | 88 |
| Lumbar, | 1 | 32 | 19 | 5 | 1 | 3 | 3 | 63 |
| " | 2 | 33 | 17 | 4 | 2 | 2 | 2 | 60 |
| " | 3 | 26 | 19 | 2 | 1 | 1 | 3 | 52 |
| " | 4 | 20 | 11 | ... | 1 | 1 | 3 | 36 |
| " | 5 | 4 | 3 | 3 | ... | ... | ... | 10 |
| Sacral, | 1 | 2 | 1 | 1 | ... | ... | ... | 4 |

Taking the percentage of the occurrence of the disease in each region, we compare the result with Vulpius' figures :

| | | *Our Observations.* | *Vulpius'.* |
|---|---|---|---|
| Cervical, | 1 | 00.1 | 3.2 |
| " | 2 | 00.2 | 4.7 |
| " | 3 | 01.4 | 3.3 |
| " | 4 | 01.2 | 2.2 |
| " | 5 | 00.9 | 2.1 |
| " | 6 | 01.6 | 2.5 |
| " | 7 | 01.2 | 2.8 |
| Dorsal, | 1 | 0.2 | 2.7 |
| " | 2 | 1.4 | 2.9 |
| " | 3 | 4.0 | 3.6 |
| " | 4 | 3.8 | 3.9 |
| " | 5 | 3.8 | 5.2 |
| " | 6 | 7.0 | 5.2 |
| " | 7 | 6.2 | 5.4 |
| " | 8 | 8.1 | 5.5 |
| " | 9 | 8.6 | 5.0 |
| " | 10 | 10.6 | 5.2 |
| " | 11 | 6.5 | 5.0 |
| " | 12 | 8.8 | 6.2 |
| Lumbar, | 1 | 6.3 | 5.0 |
| " | 2 | 6.0 | 4.5 |
| " | 3 | 5.2 | 4.4 |
| " | 4 | 3.6 | 4.2 |
| " | 5 | 1.0 | 3.9 |
| Sacral, | 1 | 0.4 | 0.0 |

The above table gives the vertebral regions and the number of times each one was affected. We find that the dorsal region is most frequently diseased and that some of the dorsal vertebræ seem to be particularly vulnerable.

If we study the subjoined table we will see which vertebral regions are affected most at different periods of life :

| | Locality. | | |
|---|---|---|---|
| *Age.* | *Cervical.* | *Dorsal.* | *Lumbar.* | *Total.* |
| 1 to 5 | 39 | 444 | 117 | 600 |
| 5 " 10 | 23 | 167 | 70 | 260 |
| 10 " 15 | 4 | 19 | 15 | 38 |
| 15 " 20 | 0 | 23 | 5 | 28 |
| 20 " 30 | 0 | 34 | 8 | 42 |
| Over 30 | 0 | 22 | 10 | 32 |
| | 66 | 709 | 225 | 1000 |

The older the patient at the time of the beginning of the disease the lower in the spine the seat of the disease was found to be.

The disease occurred only once in the first cervical vertebra, and that was in a child six years old.

During the ages ten to fifteen the highest vertebra found to be affected was the fourth cervical. After the fifteenth year no case was seen where the disease occurred in the cervical vertebræ. The highest vertebra affected was the first dorsal, and that was only once. After the twentieth year we found the highest one affected to be the fourth dorsal, and over thirty years the fifth dorsal.

In the 600 cases which occurred during the first five years of life we find that every vertebra down to the first sacral was affected, with the exception of the first cervical. After the fifteenth year no case was noted lower than the fourth lumbar.

Thus, in our cases the disease is limited to 12 vertebræ during the adult years, whereas it affected 25 during the first ten years of life.

It is interesting to compare the percentages of our cases with those which Vulpius collected. The different regions were affected as follows:

| | *Our* 1000 *cases.* | *Vulpius'* 1559 *cases.* |
|---|---|---|
| Cervical | 6.6 per cent. | 10.9 per cent. |
| Dorsal | 70.9 " | 52.2 " |
| Lumbar | 22.5 " | 36.9 " |

Or if we divide the spinal column into segments of eight vertebræ each:

| | *Our* 1000 *cases.* | *Vulpius'* 1559 *cases.* |
|---|---|---|
| Upper one-third | 8.7 per cent. | 14.6 per cent. |
| Middle " | 42.9 " | 35.4 " |
| Lower " | 48.4 " | 50.0 " |

In Vulpius' cases the cervical region is affected in a much larger percentage of cases than in ours; the lumbar region also seems to be diseased more frequently. It is only when we compare the percentage of the lower one-third of the spine that we see any similarity.

In our record the dorsal segment is affected in a very high percentage of cases, fully 18 per cent. more frequently than in the German statistics.

The question of family history is important. How many children with tuberculous parents acquire Pott's disease? We find that the fathers of 50 patients and the mothers of 46 had tuberculosis; both parents had the disease in 12 cases, while 31 others had aunts, uncles, etc., afflicted with tuberculosis. We thus see that in over 10 per cent. of the cases the patients had tuberculous parents.

The interesting observation has been made that in Colorado the children of "Lungers" were very rarely affected with tuberculous diseases of bones and joints, and that in these rare cases where the children had hip or spinal disease it ran a very mild course, hardly ever coming to the formation of abscesses and progressing favorably without any apparatus.

There have been many observations made to prove that infection is easily conveyed by inmates of the same house. We have seen children admitted to the wards of one of the orthopedic hospitals for some non-tuberculous condition leave the hospital after some months with hip or spinal disease.

*Symptoms.* An endeavor was made to ascertain the first symptom in each case. This was not difficult, as the first symptom is always recorded in taking the history of each case. In the cases occurring from birth to five there were symptoms 568 times. In 32 cases the child was brought to the hospital for some trouble not directly referable to the spinal disease.

In the cases from birth to five the symptom noted was the unnatural attitude of the child.

Of the 600 cases occurring within these years, 189 held this unnatural position, while pain was the prominent feature in 139. In 63 cases the kyphosis was the first manifestation of the disease; 126 cases were called to the attention of the surgeon by night-cries, gastralgia, and progressive weakness, while grunting respiration, inability to walk, and abdominal protrusion were present in but a very small number. At the time of the first examination of these 600 cases the record shows that there was no evidence of deformity in 157 patients. From close inspection of the tracings of those cases in which deformity occurred, we find that it was marked in 99 cases, moderate in 140, and slight in 204.

In the years from five to ten we find that pain in the back was the symptom complained of most frequently; this goes naturally with the fact of the increased age of the child enabling it to give information as to subjective symptoms, while in the cases of birth to five, the objective symptoms, attitude, deformity, and night-cries occur in the larger proportion of cases. In reference to the deformity, it may be stated that 95 of the 260 cases presented marked deformity at the time of the first examination. Recognizing, as we do, the

hopeless irresponsibility of the parents of the children we see in hospital practice, it is not surprising to find that the disease has greatly progressed before the child was brought for treatment.

In the ages from ten to fifteen and from fifteen to twenty pain was found to be the first symptom in the majority of cases, while the deformity was scarcely noticeable at the time that the patient first came under observation, although it was more noticeable in those cases occurring in from ten to fifteen years, where the deformity was of a moderate type at the time these cases were first seen. From twenty to thirty years we found that pain in the back was in the greatest number of cases the symptom, while in patients over thirty years old pain and progressive weakness were the first symptoms. The deformity was marked in almost all of these cases.

In the 1000 cases abscesses were recorded 158 times, or over 15 per cent.; during the first ten years of life 139 patients had abscesses, the greater number being psoas, fewer iliac and pelvic. Vulpius, in 1945 cases, finds abscesses clinically observed 476 times, almost 25 per cent.

While but little reliance can be placed in the statements of the parents regarding the cause, still we give the following data, having admitted to our statistics only those cases in which the cause as given seemed to bear some relation to the beginning of the disease: traumatism was responsible for 298 cases and infectious diseases for 42. Paraplegia appeared in 41 cases during the course of the disease, and 50 patients had tuberculous complications, a focus of tuberculous disease in some other joint or bone.

The duration of the disease before treatment was begun has some bearing on the prognosis. One patient continued to have symptoms twenty-nine years after the onset of the disease, another twenty-five years; several others had active disease for fourteen, thirteen, eleven, and ten years. In only one case was a child brought for treatment within twenty-four hours after it had uttered the first complaint or attention was called to the presence of the disease.

# CONGENITAL DISLOCATION OF THE HIP AND SCOLIOSIS.

By HARRY M. SHERMAN, M.D.,
SAN FRANCISCO.

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I HAVE had the opportunity of personally examining but four women of middle age who had congenital dislocations of the hips, and in three of these the lesions were bilateral. In the fourth the left hip only was affected, and there was in this case a definite scoliosis.

The association of these two deformities is not especially mentioned by many English or American writers on this subject. Mr. William Adams describes *in extenso* one of his congenital dislocation cases, and refers to a coexistent spinal lateral curve in the lumbar region, saying that at each successive examination of his patient it was less.[1]

T. Halsted Myers says of congenital dislocation: "In many of the cases I examined there was a spinal curvature, but all were due to the short limb, and, therefore, were not permanent, and were easily corrected."[2]

Bradford cites five cases of congenital dislocation as having been seen in adults, and makes the memorandum that "in none of these cases was the disability accompanied by a severe lateral curve of the spine."[3]

Finally, in none of the treatises which have lately appeared has the statement been made that scoliosis may follow, in adult years, upon an untreated congenital dislocation of one hip.

Nor, on the other hand, do those who have written of scoliosis refer to a congenital dislocation of one hip, left unreduced, as a

[1] TRANSACTIONS OF THE AMERICAN ORTHOPEDIC ASSOCIATION, vol. viii. p. 315 et seq.
[2] Ibid., vol. vii. p. 99.
[3] Ibid., vol. xi. p. 430.

cause of the spinal condition; and while pelvic obliquity, due to paralysis or to the deformity of hip-joint tuberculosis, is credited with causing a lateral deformity of the spine, the proportion of such cases is distinctly stated to be very small,[1] and this agrees wholly with my own observations.

The scoliosis in this case was of the ordinary type, with the dorsal curve convex to the right and the lumbar curve convex to the left. The amount of the spinal deformity was moderately severe. The whole spine was no more flexible nor more rigid than in old cases of simple scoliosis.

Now, I cannot assert of this case that the spinal deformity was caused by the pelvic obliquity necessitated by the dislocation, and that it was not a mere coincidence; still, I think that a causal relation did exist, and that the functional curve of the child's spine became the definite curve of the spinal deformity of the adult, and I base this partly on the fact that the two corresponded to each other, the left convex lumbar curve of the spine accommodating the tipping down of the left side of the pelvis as the short left leg tried to reach down to the ground. I have one case of a similar deformity following hip-joint excision, and in this instance it was due to unequal lengths of the legs and the lateral sway of the body as the individual balanced on the end of the femoral shaft. In each of these instances the inequality of the legs increased with time, for in a little child with a one-sided hip-dislocation the difference between the lengths of the legs is more than 1.5 cm. to 2 cm, while in the adult it may be proportionately much greater, and in all hip excision cases, when the operation has been done early in life, the difference between the lengths of the legs is likewise proportionately increased. In each of these cases, then, the spine was attached to a pelvis which was oblique, and this obliquity was always increasing—*i. e.*, the conditions favoring spinal distortion were constantly existent and constantly increasing.

I report this case merely to point out the fact that definite scoliosis may be a late result of an untreated one-sided congenital dislocation of the hip, and that this is entitled to consideration when the treatment of any individual case is under discussion.

[1] Bradford and Lovett, second edition, p. 92.

# RECOVERY FROM POTT'S DISEASE WITHOUT DEFORMITY.

By JAMES K. YOUNG, M.D.,
PHILADELPHIA.

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The most common result after recovery from spine disease is with more or less deformity. It has been customary to tell patients that the deformity which is present at the time they consult the surgeon cannot be overcome by any method of treatment, but that some diminution of the deformity may occur from compensatory changes above and below the kyphosis. This was before the introduction of Calot's operation and the growth of forcible correction of deformity by various methods. It seems possible to the writer to prevent the occurrence of deformity by early and persistent treatment, and the cases here recorded are illustrations of recovery from Pott's disease without any deformity. To accomplish this, however, the patients must be brought to the surgeon very early; they must be treated thoroughly, efficiently, and for a long period.

Case I.[1]—W. N. M. was referred to me by Dr. Horace G. Wetherill, of Trenton, N. J., now of Denver, Col., August 3, 1894. White, male, aged four years, of good family history, and well nourished. At the first examination the deformity was seen to be marked; his body was thrown forward and to the right. His right thigh was markedly flexed. He walked with a decided limp, and complained of pain in the region of the right hip. The object of the consultation was to determine whether the lesion was in the hip or the spine. The deformity was due to spasm of the psoas muscle, in addition to which there was a marked prominence of the first, second, and third lumbar vertebræ. Taylor's spine brace was applied, constitutional remedies administered, and all injury guarded

[1] Philadelphia Polyclinic, August, 1898.

against. Recovery was rapid and uneventful, and the result is a perfect cure, without any deformity and with perfect flexibility of the spine in every direction. Recovery of this kind is ideal, and is what should be sought for in every instance.

Case II.—K. R., white female, aged thirteen years; father tuberculous, mother in good health. Consulted me at the Philadelphia Polyclinic, March, 1898, suffering from a well-marked paraplegia,

Case II. Recovery from cervical Pott's disease.

with a slight but well recognizable deformity of the fifth, sixth, and seventh cervical vertebræ. The neck was so shortened that apparatus was applied with great difficulty, the head resting upon the shoulders. The body was covered with a rash, and the paraplegia was in the first stage. A spine brace with head piece was applied, and the paraplegia greatly disappeared, the neck lengthened, and the result is shown in the illustration. This is one of the most

marked and satisfactory cases of recovery from cervical tuberculosis which the writer has ever seen, and it attracted considerable attraction at the Polyclinic.

Case III.[1]—R. C., male, aged four years. Family history: Maternal grandfather died of phthisis. History of present disease: The first symptom was noticed in April, 1893. The child screamed and was rigid at night. A severe chill occurred three weeks later, attended by muscular spasm. Upon examination marked kyphosis was apparent. A Taylor brace was applied and internal medication administered. The case was admitted to the University Hospital, July 15, 1894. Patient complained of pain in the sitting posture; the spine was arched, and a fluctuating tumor was felt in the left iliac region. I operated July 20, 1894, under strict antiseptic precautions. The incision was made along the outer third of Poupart's ligament, the pus evacuated, and a counter opening made a little above the sacro-iliac junction. Iodoform dressings were applied. The sinus healed July 5, 1895. The recovery has continued, and there is at the present time absolutely no deformity present at the seat of the disease.

Case IV.—M. S., Italian female, aged six years, was sent to the Polyclinic by Dr. M. Hermance Oakley. On inspection the left hip was flexed, the abdominal walls were tense, there was swelling in the left inguinal region, there was a slight prominence of the lower lumbar vertebræ. An anæsthetic was administered and the tumor was found to be a lumbar abscess resulting from tuberculosis of the lumbar spine. The following day through-and-through drainage was established, and the patient made an uninterrupted recovery, both sinuses being healed three months after the operation. The deformity in the spine entirely disappeared, and has not returned.

Perfect recovery from spine disease can from time to time be obtained in the cervical and lumbar regions, but the writer has never seen a patient recover from Pott's disease in the dorsal region with-

[1] Philadelphia Polyclinic, August, 1898.

out deformity. The recovery may be accomplished by the early treatment of the patient, and may be expedited by the application of a well-fitting spine brace, and the prone position should be required for a long time, or from time to time, upon the advent of complications. In all of these patients the bed treatment has been continued through the acute stage of the disease, and the patients have not been permitted to walk, except for a limited period each day. In dorsal caries the patient may be prevented from sitting up or rising up in bed by the use of a heavy netting of rope fastened over the top of the crib.

A new and original method of treating tuberculous abscesses is worthy of record here, since it diminishes the danger of infection, and hence increases the possibility of recovery. It consists in making the dissection down to the abscess sac and cauterizing the skin and other structures with the Paquelin cautery before making the incision into the sac. This prevents the absorption of tuberculous and other septic germs.

# THE OPERATIVE TREATMENT OF INTERCOSTAL NEURALGIA OCCURRING IN THE DEFORMITIES OF THE CHEST FOLLOWING POTT'S DISEASE AND SCOLIOSIS.

By CHARLES F. PAINTER, M.D.,
BOSTON.

In a considerable number of cases of bad thoracic deformity the result of Pott's disease or scoliosis one not infrequently meets with cases where pain is a conspicuous feature, referred commonly to the lower ribs on one side, or to the costovertebral articulation or its immediate neighborhood. On examination one frequently can demonstrate the overlapping of the lower ribs by the iliac crests in such a way that the soft parts are pressed between these bones. In other cases it can be shown that the ribs are crowded together, causing the intercostal nerves to be similarly compressed. A further confirmation of the pressure theory is found in the fact that a supine position relieves the pain almost at once; and even in the erect position, if the extension of the trunk can be accomplished, either temporarily or permanently, cessation of the pain is secured.

That, anatomically, conditions of this sort exist in the case of bad scoliotics and healed Pott's disease can be very readily demonstrated by the X-ray. Reference to Redard's recent X-ray atlas will show several cases of both diseases where the ribs are in contact or actually overlapping. (Photographs made from these plates would not reproduce well, and are therefore not shown in this article.) Photographs are shown of the more severe grades of deformity, because they represent fairly well the types in which these neuralgic symptoms occur.

In the Pott's cases the manner in which the deformity is devel-

oped is, of course, very evident. The destruction of the bodies of several vertebræ allows the ribs to crowd together, and the shortened trunk of these patients is sufficiently familiar. These cases are more likely than the scoliotics to have bilateral symptoms, though even in these this is unusual because of the fact that an absolutely symmetrical destruction of the vertebral bodies by the tuberculous process is not likely to occur; more destruction takes place on one side than on the other. In the scoliotics the pain is unilateral, because on the convex side of the rotation there is a separation of the ribs, whereas the concave side is the one where compression occurs and where pain is commonly referred. It must be remembered that the X-rays are taken with the patients supine—a position in which, it is well known, scoliotics are taller than when standing, and that therefore the conditions are not at their worst. Indeed, clinically, that is the position when such cases have no pain, because the ribs then are the widest separated.

The problem which one has to face in these cases is a purely mechanical one, and sometimes can be wholly met by mechanical means—by the use of a swathe or a brace. Many times, however, more radical procedures are necessary, and under these circumstances excision of a rib is usually effective in bringing about a permanent cure. There is no account of operative interference in these cases which I have been able to find in the literature covered by the *Index Medicus*. So far as I know, the operation was first done by Dr. J. E. Goldthwait in 1895, and the following reported cases were operated on at the Carney orthopedic clinic upon patients who were not relieved by the less radical procedures.

The technique is simply that of an excision of the rib, and the point of election at which to operate is not chosen with a view of finding the particular nerve which is pressed upon, but to remove sufficient bone to give the ribs more room. It may be, of course, that one of the ribs is chosen which is causing the pressure upon the intercostal nerves.

The following cases are reported:

Case I.—Boy, aged twenty years. Pott's disease since he was an infant—a bad deformity, as shown in the photograph. (Fig. 1.) Complained of a great deal of pain in the region of lower

left ribs. Ribs were closely crowded together and the lower ones covered by the iliac crest; when lying down, free from pain. In January, 1900, Dr. J. S. Stone, to whom I am indebted for this case, excised the tenth intercostal rib through the incision shown in the photograph. Relief from pain on the left side was immediate. Later, symptoms developed in the other side, in a similar

FIG. 1.

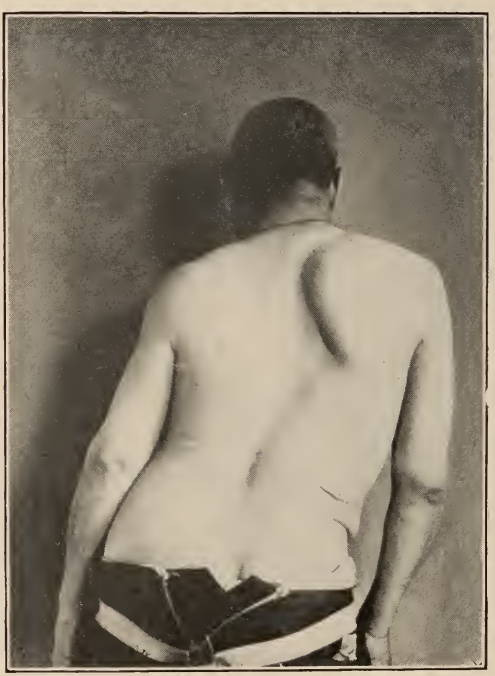
situation, but have now (August, 1901) let up, and probably were due to a tuberculous process in the right hip which has developed of late.

CASE II.—In 1895 a woman, aged twenty-five years, came to the clinic with a bad thoracic deformity, from Pott's disease; pain referred to the lower tight ribs. A tight swathe was tried for a time, but with no effect; and later still a back brace—also to no

purpose. The pain was wholly relieved by recumbency. Dr. Goldthwait removed about four and a half inches of the tenth rib on the right in January, 1896. This gave entire and permanent relief to the pain, and she was enabled to resume her work, which she had been obliged to give up on account of the pain. She was last heard from in 1899.

Case III.—Male, aged fifty years. Laborer for the Street-Cleaning Department. When twenty-eight years of age he sus-

Fig. 2.



tained a fracture and dislocation of the left shoulder. (Fig. 2.) As a result of this he has never been able to raise the left arm but a very few degrees from his side. For the past twenty years he has used the heavy broom used by crossing sweepers, and has gradually developed a right dorsal rotary curve to the spine. For two years before coming to the clinic in 1898 he had been

able to work only very short hours because of pain in the left lower ribs. This was partially relieved by a tight plaster swathe applied as in fractured ribs, but yet he was unable to do his work as a crossing sweeper. In December, 1900, four inches of the eleventh rib was excised, with very considerable relief to pain, so that he has been at work since; but there is still some soreness in that same region. He was a much older patient than the others, and had some osteo-arthritic changes going on, which doubtless complicated matters.

Case IV.—N. M., female, aged twenty-three years. Had Pott's disease at six years of age, which left her a very much shortened trunk, due to a knuckle in the back involving five or six of the mid-dorsal vertebræ. This caused her no trouble until two years ago, when she began to have pains referred to the lower ribs on both sides, especially the left, where the ribs were pressed down inside the iliac crests. Pain entirely relieved by recumbency and not effected by tight swathes. The discomfort was severe enough to keep her from doing her work as a mill operative. In November, 1901, the tenth intercostal rib was excised back to the angle. This gave immediate relief; but since then she has had so much pain on the right side that she has had to resort to the use of a swathe, which partially relieves that side.

Case V.—M. K., male, aged twenty-five years. As an infant had Pott's and hip disease, leaving him with an ankylosed right hip in the position of right-angled flexion and a very marked knuckle in the spine, as shown in the photograph. (Fig. 3.) The ribs are very much compressed and crowded down inside the iliac crests. A subtrochanteric osteotomy was done in 1898 upon the hip. In the early part of 1900 he began to complain of a great deal of pain in the left back, beginning at the spine below the scapula and extending around to the front. A brace with heavy pad, giving compression over the painful ribs, served for a while to give some relief, but it was not possible to work all the time. After a few months' trial the eleventh rib was excised, with immediate and permanent relief. Has had no trouble since.

Case VI.—C. D., male, aged twenty-one years. This patient has one of the most extreme grades of scoliosis that I have ever seen. The deformity was noticed first when he was thirteen years of age, and steadily increased in spite of braces, jackets, exercises,

Fig. 3.

and three months in bed. When lying in bed he was nearly three inches taller than when standing. During the past year and a half he has complained of considerable pain when standing or sitting, referred to the mid-thoracic region on both sides. This is relieved by recumbency. His general condition has rather con-

traindicated operation, and a swathe tightly applied has kept him fairly comfortable.

Case VII.—M. D., female, aged twenty-three years. This young woman had Pott's disease twelve years ago. The process was a rapidly destructive one, and the knuckle, composed of three or four dorsal vertebræ, is quite sharp. Four years ago she first began to complain of pain referred to the right lower ribs. A back-brace which tended to hyperextend the trunk, with a leather swathe attachment, gave her entire relief for three years. The pain returned coincident with the wearing out of the brace, and has again been relieved by putting the brace into condition again. This patient, as the others, was perfectly comfortable while she remained recumbent.

Case VIII.—E. G., female. This patient had a very similar condition to Case IV. of this series, viz., a right-angled flexion of the thigh from hip disease, and an extreme deformity from Pott's disease in the dorsal region. She complained a great deal of pain in the lower thoracic region on both sides, especially the left. Three and a half inches of the tenth rib were excised, with marked relief of symptoms in the left side. A light canvas swathe reinforced with whalebone has partially relieved the right side.

These cases represent only the most striking ones of this condition coming to the clinic in the last six years. There have been several others with similar symptoms, but relief has been secured by the less radical procedures.

# CONGENITAL ELEVATION OF THE SHOULDER: A REPORT OF TWO CASES, TREATED BY OPERATION, ILLUSTRATING THE TWO TYPES OF THE DEFORMITY.

By JOEL E. GOLDTHWAIT, M.D.,

AND

CHARLES F. PAINTER, M.D.,

BOSTON.

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The following cases are reported as illustrating the two types of the condition described as "congenital elevation of the shoulder."

In one the position was probably due entirely to the imperfect development of the muscular structures, and is analogous in every way to congenital torticollis, in which the Sterno-Cleido-Mastoid muscle is imperfectly developed. It is possible and not improbable that in this condition an injury at the time of birth may be the cause of the trouble, as has been clearly demonstrated in the case of torticollis.

In the other case the position of the shoulder is associated with an embryological condition, there being a direct articulation between the upper angle of the scapula and the vertebræ.

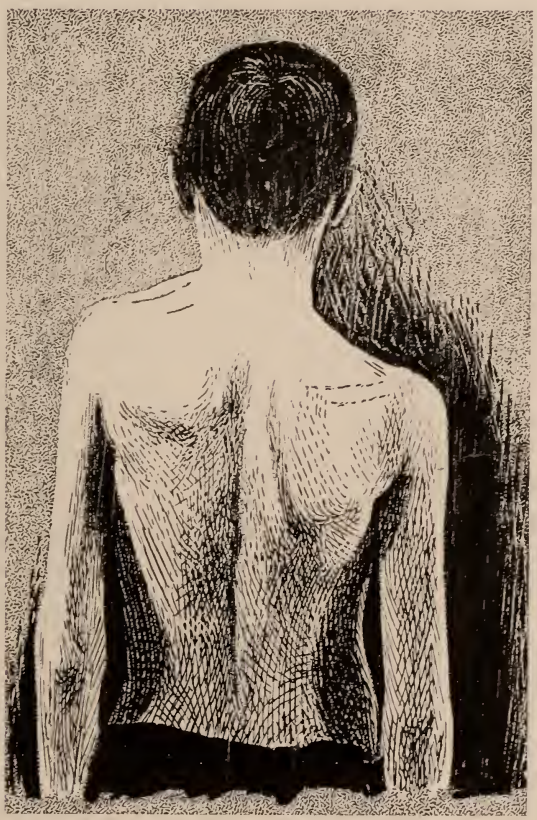
Both cases have been operated upon, with improvement in the appearance of the patient and with practically normal results in regard to function

E. H., a boy, aged twelve years, was brought to the Children's Hospital, October 6, 1900, because of the position of the left shoulder. The peculiarity was noticed first when the child was a year old. There has been no known injury or other cause for this condition. As the child has grown the condition has become more marked.

At the time of the first examination the arm could be used freely, and except for the fact that the whole shoulder was elevated, as is shown in the photograph (Fig. 1), there was no disability.

On November 7 the child was operated upon. An incision six inches long was made, extending fromt he middle of the top of

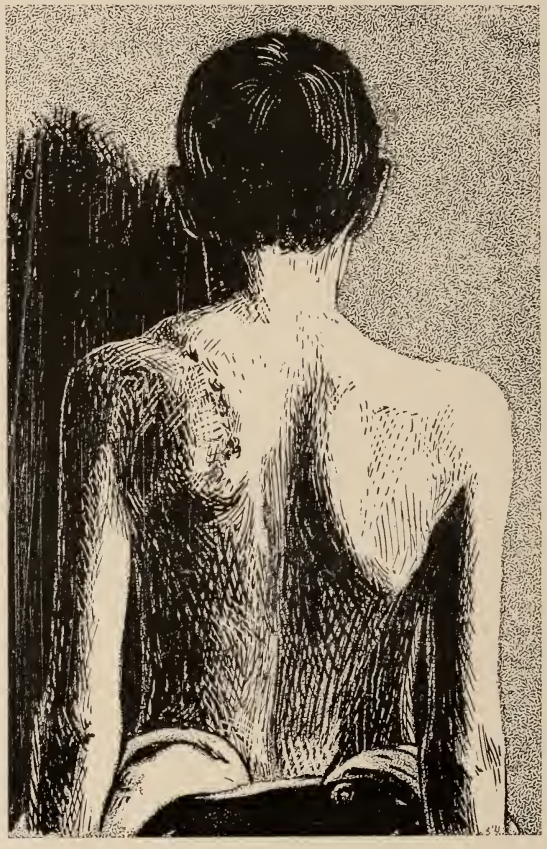
FIG. 1.



the scapula to the angle below, and carried down to the attachment of the Trapezius muscle. The attachment of this muscle to the spine of the scapula was divided and the lower half of the muscle folded back so that the Rhomboid muscles on the inner edge of the scapula could be exposed. Both of these muscles contained

little muscular fibre, and were represented largely by fibrous tissue. Both muscles were divided, as was also the Levator Anguli Scapulæ. After this it was possible to draw the scapula to the side, but it could not be depressed sufficiently, owing to the lower portion of the Serratus Magnus, which was shortened. This was divided and the

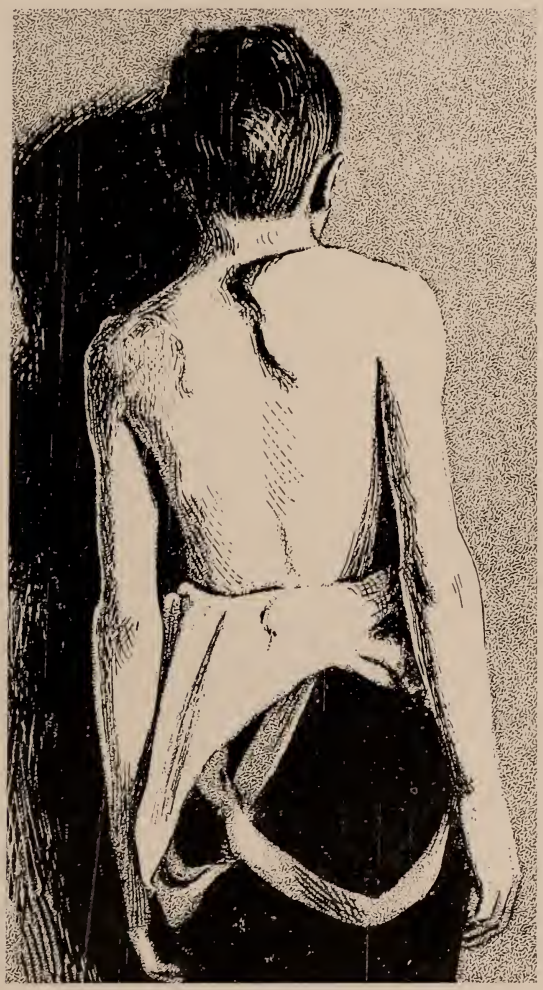
Fig. 2.



scapula brought down as far as possible. A perfect position could not be obtained, owing to the fact that the portion of the scapula above the spine was bent forward instead of being flat, as it is normally. There had been so much improvement, however, that it did not seem wise to attempt to correct this feature. Accordingly, the

tendon of the Trapezius muscles was re-attached a little higher up on the spine of the scapula than normal, in order to draw the shoulder down, and the wound closed. For dressing, the arm

FIG. 3.



was put up so that the outer part of the shoulder was elevated as much as possible in order to throw the lower angle of the scapula far out at the side. With this a strap was carried tightly across the

inner portion of the shoulder, so that this portion of the scapula was drawn down as far as possible, and entirely reversing the angle of the bone as it was before the operation.

The recovery was uneventful. Passive motion was begun at the end of two weeks, active motion a little later, with a gradual increase of both, the chief aim being to develop the muscles which would tend to hold the shoulder in the best position.

The result is shown in the photograph (Fig. 2). Functionally the arm can be used normally.

E. C., aged eleven years; had always been a healthy, active boy. Since early childhood the parents have noted that he was "stoop-shouldered," and that this has increased as he has grown older, and the head has been bending over more and more, as is shown in the photograph (Fig. 3). His brothers and sisters are well, and there are no congenital deformities among them. The use of the arm has not been restricted except in the extreme of elevation of the extended arm from the sides—no limitation which would interfere with the usual and habitual exercise of the arm. There is marked facial asymmetry as in the congenital torticollis. In the past year or two the cervical deformity has increased so rapidly that he was brought on that account.

Examination shows a fairly developed boy. Right arm one-half an inch smaller than the left; forearms equal and of about equal strength, as tested by the grip. The right scapula was small, as could be seen in the X-ray. The lower angle of the right scapula was at about the level of the middle of the vertebral border of the left. There was slight atrophy of the Supraspinatus and Infraspinatus on the right. On raising the arm laterally motion was possible scarcely beyond a right angle, and the lower angle of the scapula projected sharply; even with the arm at rest it was more than ordinarily prominent. There was a sharp curvature of the cervical spine, convexity to the left, with prominence of the spine of the seventh cervical vertebra. The axillary and vertebral borders of the scapula were not bound down. The upper angle of the right scapula was attached to the vertebral column by an osseous band, which allowed of motion upon this as a pivot.

On September 2, 1901, an incision was made over the point of

attachment of this osseous band to the scapula. On dissecting it clear it was found to be about one and one-quarter inches in length, three-quarters of an inch in width, and one-quarter of an inch in

Fig. 4.

thickness. The vertebral end was attached to the seventh cervical vertebra coming from its transverse process. It was this which as it grew apparently had pushed the cervical vertebra over to the left. There was an articulation at the scapular end and also at the

vertebral end. Both were removed. Its removal permitted the scapula to move freely and normally, as well as could be judged under ether.

The wound healed by first intention, and under massage and exercises, with suspension by the head sling, to correct the position of the cervical spine, there has been distinct improvement, as is shown in Fig. 4.

No attempt has been made to present the literature on the subject, as it has quite recently been fully reported by Rager in the *Zeitschrift für Orthopädische Chirurgie*, Band ix., Heft 1, but a case illustrating each type of the condition seemed of enough interest for individual report.

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## DISCUSSION.

Dr. V. P. Gibney said that he had had a case similar to that of Dr. Goldthwait, upon which he had operated eight or nine years ago. He had operated upon it and had secured a good position of the shoulder. The history of the case was as follows:

A girl, in December, 1891, five and one-half years of age, presented a dislocation of the left scapula upward, so that the upper angle was one and one-half inches from the mastoid process, while the lower angle overlapped the spinous processes and impinged on the upper angle of the right scapula. There was little or no deviation of the spinal column. The history was that when about eighteen months of age, she was found to have a fracture of the clavicle. It was not known whether this had anything to do with the deformity of the scapula.

At St. Luke's Hospital, Utica, N. Y., on January 9, 1892, I made an incision over the upper angle of the scapula, extending a little to the left of the spinous process of the last cervical vertebra and downward toward the middle of the scapula itself. This enabled me to reach the muscular attachments of the scapula. These were divided by scalpel and scissors. It was found then that the scapula could not be brought down into position by reason of the muscular attachments along the border next the spinal column. With my finger as a guide and a pair of curved scissors, all these muscular

attachments were divided. I was then enabled to shift the scapula backward into its normal position. A counter opening was made at the lower angle through the skin, and several strands of catgut were drawn through as drains. The main wound was sutured. The head was put in position of over-correction. After a full dressing plaster-of-Paris was applied, with a bit of steel curved like a croquet-ricket incorporated in the plaster over the shoulder. The dressing was not removed until January 17th, when the wound was found very nearly healed. The scapula was in normal position. The wounds were quite healed by January 25th; position good. On February 8th the angle of the scapula was three inches from the mastoid process. The lower angle does not overlap the spinous processes, and does not impinge on the upper angle of the right scapula. There is no rotation of the spinal column. I had a special brace made for her.

My last observation was on May 14, 1894, when she showed no deformity through the dress. The left shoulder was a shade higher than the right, on close inspection. The lower angle of the left scapula reaches quite to the spinous processes, but does not go beyond. It is on a plane two inches higher than the right, and projects about one-half inch further backward. The upper angle of the scapula is three and one-half inches from the mastoid process. There is no curvature of the spine; no rotation. She has worn no support for a year and a half. A recent letter from Dr. Willis Ford, who had referred the case to me, gives substantially the same report as just recorded.

Dr. Weigel said that a few months ago he had reported a case of spontaneous dislocation of the hip occurring during typhoid fever. He had seen it within four months after the occurrence of the dislocation, and had advised operation. The patient had refused, so he attempted reduction, and had apparently succeeded in this. After two weeks the dressing had been removed, and the dislocation had immediately returned. A second attempt had been equally ineffectual, but the parents would not consent to operation. He had succeeded in converting the case into an anterior dislocation, which removed much of the disability. In the communication referred to he had called attention to the changes which might take place in the head of the femur in the course of time, and which would preclude

a perfect result by any plan of treatment. A radiograph taken at the end of two years showed that the head of the femur had been converted into a small hook-like process. This showed how useless it was after a certain time had elapsed for one to operate with the idea of finding a normal femoral head. In these cases the capsule was greatly stretched and relaxed, and when the femur is pulled down the capsule probably folds upon itself and enters the acetabulum in advance of the femoral head, and prevents stable reduction.

Dr. Whitman said he had operated two weeks before, reducing without difficulty a dislocation following scarlatina. A general polyarthritis had occurred about two weeks after the onset of the disease, and he had seen the case about four weeks after the displacement had occurred. After reduction he had applied plaster-of-Paris spica, and expected a good result. He had also reduced cases caused by rheumatism and typhoid fever.

Dr. Clarence L. Starr, of Toronto, said that the case presented had interested him considerably, and he wondered if Dr. Goldthwait had noted the similarity existing in the muscles with the condition found in torticollis. In torticollis the muscles had become fibrous bands, and the contraction of these bands drew the head down because the lower attachment was fixed to the clavicle and ribs. In this case the levator anguli, scapula, and rhomboids were fibrous, but their contraction elevated the scapula instead of depressing the head, because the lower attachment was the freely movable scapula. A point of interest was also the etiology of these conditions. The fibrous condition of the sternomastoid in torticollis was supposed often to be due to a hæmatoma at birth, but in this case there was evidently none.

Dr. B. E. McKenzie said he had recently had a young woman with very decided shortening of the trapezius and other muscles passing from the occiput to the cervical spine. It was clearly a case of acquired shortening. Since eight years of age this young woman had assiduously practised the violin and had assumed this position. He was employing massage and extension, and was not prepared to say what the result would be. He would like to know whether Dr.

Steele remembered that the speaker had reported several joint lesions following scarlet fever, one of them a double dislocation of the hip, and another a dislocation occurring in an adult, apparently following acute rheumatism. In the latter case the dislocation had been successfully and easily reduced, and had been followed by complete ankylosis in a new position.

Dr. A. M. Phelps said that if on any joint which had become dislocated from any pathological cause an operation were done, suppuration and ankylosis were likely to occur. If the dislocation could not be easily reduced an excision was better, for it furnished a fairly good hip, with about two inches and a half of shortening, and without risk of subsequent suppuration. He believed it was overdistention of the capsule which forces the bone from the socket, and the spasm of muscles always present in joint disease pulls it out posteriorly.

Dr. A. H. Freiberg, of Cincinnati, said that the case reported by Dr. Goldthwait was peculiarly interesting to him, because in 1899 he had reported a case of elevation of the scapula. He had recently obtained a photograph of the child, and it showed how greatly the scoliotic condition had increased. The shoulder could not be abducted beyond 100 degrees from the vertical. The parents refused to have any operation done. Possibly the chiselling off of the superior angle of the bone, as had been done by a number of surgeons, might relieve the condition; but in this particular case there was decided deformity of that side of the chest, and it had appeared to him that even if the superior angle were removed there would remain considerable deformity, hence he had not urged operation. These cases of elevation of the scapula may be classified in several groups. In one of these groups came the cases in which there is synostosis between the scapula and the spine and there is considerable disturbance of function. In others the functions of the joint are normal, but the scapula is unusually high. Such a case he had seen only a few weeks ago in a child of ten months. There was no other deformity, and the child was perfectly healthy.

Dr. A. J. Steele asked Dr. Goldthwait regarding the mobility of the displaced scapula.

Dr. Goldthwait said that the large rhomboid had been chiefly affected, being converted into a fibrous band. The scapula was not movable until the muscles were cut.

He had seen two cases, one adult and one child, in which dislocation had occurred after acute articular rheumatism, and one dislocation of both hips, occurring after diphtheria.

# THE EFFECT OF OSTEITIS OF THE KNEE ON THE GROWTH OF THE LIMB.

By HENRY LING TAYLOR, M.D.,
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It has recently been shown[1] that retardation of growth of the limb is an important cause of shortening after osteitis of the hip. A year or more after the onset of the disease the long bones of the affected limb are considerably shorter than those of the well side, and this difference increases during the period of growth. The examination of specimens and radiograms shows that the bones are narrower and less dense as well as shorter, and that the corresponding side of the pelvis is similarly affected. Only in rare cases can a slight lengthening of the bones of the limb be detected in the earlier stages.

When the tuberculous process affects the knee-joint the results are somewhat different, and this study is based upon measurements of the lower limbs, of their upper and lower segments, and of the feet and patellæ in 40 cases of osteitis of the knee. The limbs were measured from the anterior iliac spine to the internal malleolus in all but two cases (Nos. 13 and 39), where the length was reckoned by addition, owing to considerable flexion; in the remaining cases the deformity was slight. There are, however, a few apparent discrepancies in the figures due to this and other causes. The upper segment was measured from the anterior iliac spine to the depression between the femur and tibia on the inner side of the knee. The tibia was measured from the latter point to the internal malleolus; the foot from the end of the great toe to the end of the sole, and the transverse diameter of the patella was taken.

[1] Dr. Russell A. Hibbs. New York Medical Journal, December 16, 1899. The writer, Philadelphia Medical Journal, January 26, 1901.

The cases have been tabulated, according to the onset of knee-joint symptoms, into three classes: First, those in whom the disease had existed less than three years; second, those in whom the duration was at least three and less than five years; and, third, where the affection had begun more than five years before.

CLASS I.

| No. | Sex. | Age. | Side. | Duration years. | Difference (inches). Limb. | Femur. | Tibia. | Foot. | Patella. |
|---|---|---|---|---|---|---|---|---|---|
| 1 | M. | 8 | Right | 1/6 | = | | = | = | = |
| 2 | M. | 8 | Left | 1/2 | 3/8 | 1/2 | —1/8 | | |
| 3 | F. | 4 | " | 1/2 | 3/8 | ... | 3/8 | —1/8 | = |
| 4 | F. | 3 | Right | 1/2 | 1/4 | 1/4 | = | —1/8 | = |
| 5 | F. | 3 | Left | 1/2 | 1/4 | 1/4 | = | 3/8 | —1/8 |
| 6 | M. | 8 | " | 1 | 3/4 | 1/2 | 1/4 | | |
| 7 | M. | 9 | Right | 1 | 3/4 | 3/4 | = | = | —1/4 |
| 8 | F. | 16 | " | 1 | —1/4 | = | —1/4 | | |
| 9 | F. | 8 | Left | 1 | 1/4 | 3/4 | —1/2 | | |
| 10 | M. | 5 | Right | 1 | 3/8 | 1/2 | 1/8 | = | —1/4 |
| 11 | M. | 8 | " | 1 | 1/8 | 1/2 | —1/4 | —1/8 | —1/4 |
| 12 | F. | 3 | " | 1 | 1/2 | 1/2 | —1/8 | —1/2 | —1/8 |
| 13 | M. | 5 | Left | 1 | 3/8 | 1/4 | 1/8 | —1/4 | —1/4 |
| 14 | M. | 13 | " | 2 | 1/4 | 1/2 | —1/4 | —1/2 | —3/8 |
| 15 | F. | 3 | " | 2 | 7/8 | 1/2 | 1/4 | —1/4 | —1/4 |
| 16 | F. | 8 | " | 2 | 1/8 | 3/8 | —1/2 | —1/4 | —1/4 |
| 17 | F. | 3 | " | 2 | 1/2 | 3/8 | 1/4 | —1/8 | —1/4 |
| 18 | F. | 11 | " | 2 | 1/8 | 3/8 | —1/2 | = | —1/4 |
| 19 | M. | 12 | Right | 2 | 1/2 | 3/4 | —1/4 | —1/8 | —1/8 |
| 20 | M. | 9 | Left | 2 | 1/8 | 5/8 | —3/8 | —1/2 | —1/2 |
| Average | ... | ... | ..... | ..... | 0.27 | 0.42 | —0.09 | —0.18 | —0.19 |

CLASS II.

| No. | Sex. | Age. | Side. | Duration years. | Difference (inches). Limb. | Femur. | Tibia. | Foot. | Patella. |
|---|---|---|---|---|---|---|---|---|---|
| 21 | F. | 10 | Left | 3 | 1/4 | 1/2 | —1/2 | —1/2 | —1/8 |
| 22 | M. | 5 | " | 3 | —1/8 | | —1/8 | —1/2 | —3/8 |
| 23 | F. | 3 | Right | 3 | 1/4 | 1/4 | = | —1/4 | = |
| 24 | M. | 6 | Left | 3 | 3/8 | 1/4 | = | —1/4 | —1/8 |
| 25 | F. | 8 | Right | 3 | 3/4 | 3/4 | = | —1/4 | —1/4 |
| 26 | M. | 7 | Left | 4 | —1/4 | = | —1/4 | —1/8 | = |
| 27 | F. | 7 | " | 4 | 1/2 | 1/4 | 1/4 | | |
| 28 | M. | 8 | " | 4 | 3/4 | = | 1/2 | —1/4 | —1/8 |
| 29 | M. | 8 | " | 4 | 1/4 | 1/4 | = | —1/4 | —3/8 |
| 30 | M. | 13 | Right | 4 | = | 3/4 | —1 | | |
| Average | ... | ... | ..... | ..... | 0.27 | 0.33 | —0.11 | —0.29 | —0.17 |

In the first class (see table) there were 20 cases between the ages of three and sixteen years, with a duration of symptoms from a few months to two years and a fraction. In this class the measurements

CLASS III.

| No. | Sex. | Age. | Side. | Duration years. | Difference (inches). Limb. | Femur. | Tibia. | Foot. | Patella. |
|---|---|---|---|---|---|---|---|---|---|
| 31 | F. | 14 | Right | 7 | —3 | —1 | —2 | —¾ | —⅜ |
| 32 | F. | 9 | Left | 8 | 1 | ¾ | 1¼ | —⅛ | —⅛ |
| 33 | M. | 9 | " | 8 | = | ⅜ | —⅜ | —1¼ | —1¼ |
| 34 | M. | 16 | " | 8 | —2½ | —1¼ | —1 | —½ | —⅝ |
| 35 | F. | 9 | " | 8 | 1 | ¾ | 1¼ | —⅛ | —⅛ |
| 36 | M. | 14 | " | 10 | —1 | | | | |
| 37 | F. | 26 | Right | 10 | —½ | | | | |
| 38 | F. | 24 | " | 13 | —2 | | | | |
| 39 | M. | 21 | " | 17 | —4 | —1¼ | —2¾ | —1¼ | |
| 40 | M. | 45 | " | 42 | —3 | —2 | —¾ | —¾ | —½ |
| Average | ... | ... | ..... | ..... | —1.4 | —0.52 | —0.91 | —0.54 | —0.33 |

of the limb, from the anterior iliac spine to the internal malleolus, showed lengthening on the affected side in all the cases but two. In one, where the duration was only two months, the limbs were equal; and in one the affected limb was ¼ inch shorter. This case was sixteen years old, the oldest of the group, and therefore past the period of active growth. The remaining 18 cases showed lengthening of from ⅛ to ⅞ inch on the affected side, with an average of about ¼ inch. This lengthening was in 17 cases mainly or entirely in the femur, which showed a difference of from ¼ to ¾ inch in favor of the affected side. In one case only (No. 3) was all the lengthening in the tibia. In the sixteen-year old case the femora were of equal length, and in Case No. 1 the femora were not measured.

The affected tibia was shorter in 10, equal in 4, and longer in 6. In all the cases of equality the disease had been of short duration; in 3 less than a year. The shortening in the 10 cases was from ⅛ to ½ inch. Lengthening in the 6 cases was from ⅛ to ⅜ inch. The average difference for all the cases measured about $\frac{1}{10}$ inch of shortening.

The foot of the affected side was shorter by ⅛ to ½ inch in 12 cases; in 4 cases it was equal, and in 4 cases not measured.

The transverse diameter of the patellæ was, in 3 cases of short duration, equal; in 4 cases not measured, and in 13 cases the patella of the affected side was from ⅛ to ½ inch narrower.

In 10 cases, with a duration of the disease of from three years to four and a fraction (Class II.) the affected limb was longer by ¼ to

$\frac{3}{4}$ inch in 7; in 1 the limbs were equal, and in 2 the affected limb was shorter by $\frac{1}{8}$ to $\frac{1}{4}$ inch. The average was a lengthening of about $\frac{1}{4}$ inch.

The affected femur was longer in 7 cases by $\frac{1}{4}$ to $\frac{3}{4}$ inch; and the femora were equal in 2, and not measured in 1. The average was a lengthening of $\frac{1}{3}$ inch.

The affected tibia was shorter in 4, longer in 2, and equal in 4.

The feet were compared in 8 cases, and in all there was shortening. The average shortening was greater than in Table I.

The patella was narrower in 6 cases, equal in 2, not measured in 2.

In Class III. are recorded the measurements of 10 cases, where not less than five years had elapsed since the beginning of the disease. It happened that no cases presented themselves with a duration of five or six years, so that the duration was actually seven years or more. In many of these cases the disease had long ceased to be active.

In this class the affected limb was shorter in 7 cases by $\frac{1}{2}$ inch to 4 inches; longer, by 1 inch in 2, and equal in 1. The 3 cases not showing shortening were the youngest in the class and still in the sensitive and growing period.

In 7 cases the femora were measured, and 4 showed marked shortening; in the 3 young cases, considerable lengthening.

In these 7 cases the tibia showed shortening in 5, in 4 marked; slight lengthening in 2.

There was marked shortening of the affected foot and narrowness of the patella in all the cases measured.

The results of this study tend to show that after osteitis of the knee in childhood:

1. The affected limb, when approximately straight, is nearly always longer in the first two years; usually longer in the second two years, and usually markedly shorter after seven years' duration, if the period of growth is past.

2. The affected femur is nearly always longer in the first four years, and the lengthening of limb is mainly due to the lengthening of the femur. The lengthening of the femur may often be detected within half a year of the onset. After seven years' duration—that is, some time after cessation of active disease in most cases—the femur in adults and adolescents is considerably shortened.

3. The tibiæ are usually equal in length in the earlier stages; afterward the affected tibia may be slightly longer for a time, but is more often shorter in the first two years. This shortening increases in the older cases and after the subsidence of inflammation.

4. If the limbs are of equal length some years after the onset of the disease the femur of the affected side will be found longer; the tibia shorter than its mate (Nos. 30 and 33).

5. The foot and patella of the affected side often show a difference in favor of the well side in the first year, and nearly always with a longer duration.

6. This study would favor the inference that growth at the lower end of the femur is stimulated during the active stage of the disease by the proximity of the epiphyseal junction to the diseased area; that after the disease becomes quiescent stimulation ceases, and growth of the part is retarded; that the stimulating effect, so far as is evidenced by increased growth in length, is slight at the upper end of the tibia, and that growth very soon begins to be retarded in parts of the affected limb remote from the lesion.

This general retardation of growth seems to progress hand-in-hand with the local acceleration, and finally preponderates. In adult life, years after the subsidence of a disease which began in early childhood, the final result is often a shortening of from one to several inches.

# REPORT OF A UNIQUE CASE OF DUPUYTREN'S CONTRACTION. OPERATION BY THE OPEN METHOD.

By FRANK E. PECKHAM, M.D.,
PROVIDENCE.

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After operating several cases of Dupuytren's contraction by the subcutaneous method, and learning that the results are not always perfect and that recurrence is not unknown, and after reading reports of cases by A. H. Tubby where the open operation was done, I decided to make use of this method of treatment in the following case :

The patient was a policeman, forty-five years of age, who was sent into the Rhode Island Hospital in January, 1901. About six years before he had noticed a dimpling of the skin at the base of the third finger of the left hand on its palmar surface. The finger slowly became stiff and contracted, so that finally he was unable to straighten it. Two years ago the third finger of the right hand became affected in the same way, and as this condition became progressively worse he sought medical advice. The finger on the left hand was flexed one-half of normal and was stiff. Dimpling was easily seen at a point about over the metacarpophalangeal joint, and upon any attempt to forcibly straighten the finger there was pain referred to the site of the dimple and the palm of the hand. The finger on the right hand was contracted about one-half as much as on the left.

The operation was done January 27, 1901. On the left hand a longitudinal incision was made along the course of the tendon and a transverse incision just at the base of the finger. The flaps were then dissected up, especial care being taken to get just the skin, leaving the fat tissue as far as possible *in situ*. At the site of the dimple was found a hard nodule in the fat tissue, with adhesive bands attaching it firmly to everything surrounding it; skin, fat tissue, and tendon sheaths and both tendons were firmly bound

down, so that playing back and forth in their sheaths was impossible. This mass was about over the metacarpophalangeal joint, and when dissected out measured about five-sixteenths of an inch in diameter. The tendons were then freed by blunt dissection, but the finger could not be straightened on account of the contracted tendon of the flexor sublimis digitorum. A lengthening operation was then done, making it one-half to three-fourths inch longer, when the finger was easily placed in complete extension.

On the right hand a similar longitudinal and transverse incision was made, but, on dissecting down, the trouble was found to be in the tendon itself. The skin, fat tissue, and tendons were all firmly bound down at one place, allowing no movement whatever. After dissecting away the fibrous bands and loosening the tendons by the blunt dissector there were found two growths about one-fourth inch apart in the tendon itself. The tendon was very much atrophied, the growth apparently having taken place at the expense of the tendon tissue, and about one inch in length was excised in order to completely remove the growth. Even then the finger could not be straightened until the deep flexor tendon was cleared from the fibrous adhesions. The proximal end of the divided tendon was so small and string-like that tendon suture was impossible, consequently the distal end of the flexor sublimis digitorum was grafted into the flexor profundus digitorum near the base of the finger. The wounds were closed with silkworm-gut. Where the two incisions crossed there was an area on each hand, which healed by granulation, thus making the after-treatment quite prolonged, and it was not until March 25th that the wound was completely filled in, and the scar was not completely free from scab until two weeks later.

Both hands were placed on splints for several weeks, in order to prevent flexion from scar tissue, and when they were omitted the joints were quite stiff, and passive motion was necessary for two or three weeks in order to restore the flexibility. It is now about four and one-half months after operation. The result in the left hand is perfect, motion in flexion and extension being normal. In the right hand the phalangeal joints can be only partially flexed, but a gradual improvement is taking place, giving promise of more complete flexion than exists at present. This is the hand where tendon grafting was done.

It was a disappointment that the after-treatment was so extended, but I think that can be avoided in the future by omitting the transverse incision, which will render healing by first intention much more probable, and such an incision had no especial advantage in the case reported. Another time also the flaps could be dissected, together *with* some of the fat tissue, thus favoring healing by first intention and without so much tendency to scab formation. After doing the subcutaneous operation it is very apt to be difficult to straighten the finger, and splinting is necessary for a long time. The above case would suggest that this may be due to a contracted tendon rather than any joint stiffness, and an open operation would at once reveal such condition and allow of immediate correction by a lengthening operation.

In all cases collected I was unable to find any where the growth was in the tendon itself, consequently in the right hand a unique condition existed. I would emphasize the caution given in Tubby's article regarding the necessity of a bloodless field for operation. On one hand, the Esmarch and tourniquet were both used, and the operation was done with great ease; but, on the other, only the tourniquet was used, and although there were not spurting arteries, yet the field was constantly obscured by the oozing of blood from below the tourniquet. Reasoning from the conditions found in the above case, it would seem that the open method of operating was to be preferred, in that it gives a chance to overcome all difficulties presenting, while the subcutaneous method can only deal with a few.

## Pathologist's Report.

By F. T. Fulton, M.D.

Specimen consists of two bits of tissue, one from a tendon and the other from the subcutaneous fatty tissue of the palm. The one from the tendon is elongated, measuring $2\frac{1}{2}$ cm. x 5 mm. x 2 mm. It is firm, reddish, and granular. The surface is shaggy, as though the specimen had been adherent. The other specimen is discoid in shape, 1 cm. in diameter and 5 mm. in thickness. It is paler than the first, firm; surface is reddish and rough, covered with fibrous tags. It is surrounded by a small amount of fat tissue.

Histologically the bit of tissue from the tendon is made up chiefly of long, slightly wavy, dense, connective tissue fibrillæ, between which are a moderate number of very slender, elongated nuclei. Attached to this at one place is a very small area, which is made up of connective tissue fibres more irregularly arranged and considerably richer in cells.

A section from the specimen from the palm shows it to be made up of a more or less encapsulated tissue composed of very irregularly arranged, considerably elongated, spindle cells. In some places in the section the tissue is very dense, almost hyaline, but only in small areas. The tissue is far more cellular than in the first specimen. It is scantily supplied with bloodvessels. There are nowhere in either specimen any indications of acute inflammation, nor are there any areas of infiltration with lymphoid or plasma cells.

# DUPUYTREN'S CONTRACTION OF THE PALMAR FASCIA.

By NOBLE SMITH, F.R.C.S. (Edin.), L.R.C.P.,
SENIOR SURGEON TO THE CITY ORTHOPEDIC HOSPITAL, LONDON.

In 1883, I made an inquiry upon the subject of Dupuytren's contraction of the palmar fascia, the result of which I read before the Royal Medical and Chirurgical Society of London, on March 25, 1884.[1] I propose now to refer to some points which were not brought forward in that paper.

It had long been thought that the affection did not occur in women, until Keen, of Philadelphia, published statistics which showed a proportion of 20 females to 106 males. But even when I read my paper an impression prevailed in England that the affection was extremely rare in women, and at the meeting above referred to Mr. William Adams stated that he had only seen 6 cases in females. In my inquiry I found 11 cases of clearly defined Dupuytren's contraction among 444 women whom I examined in workhouses, and I produced 6 of these women at the meeting referred to. In addition to these 11 cases I had also found among these 444 women 15 others in whom there was indurated and thickened palmar fascia, although the fingers were not contracted.

These 11 distinct cases of the deformity in women represent about $2\frac{1}{2}$ per cent., which is a much greater proportion than is generally found among females. Among 300 old men I found 45 cases, and this is, of course, a remarkably high percentage (15 per cent.).

These statistics contrast very strongly with those of other inquiries. For instance, the late Mr. William Anderson, in his book on *Deformities of the Fingers and Toes*, stated that he had only found 33 cases in 2600 adults, and in 800 children whom he also examined

[1] At that time the medical journals gave abbreviated accounts of the paper, but it appeared in full in the British Medical Journal of February 7, 1885.

he did not find a single case. The difference in these observations has a great value in throwing light upon the age at which this deformity mostly begins. Young people seem to be practically exempt.

In Mr. Anderson's cases five-sixths of the patients were over middle age, but in only 18 were the patients over sixty, showing, I should assume, that the patients examined were younger than those from whom I derived my cases, and it is only natural that the inmates of workhouses should be older than those who are found in infirmaries.

Among the 45 cases of males which I found in St. Marylebone, City Road, and St. Pancras' workhouses, the individuals were considerably above middle-age (assuming middle-age to mean about forty), no patient was below sixty-three years of age, and the disease had begun in probably every case after the age of fifty. These points are shown in the following table:

| Age of patient. | Duration of disease. |
|---|---|
| 74 | 2 years. |
| 72 | 2 " |
| 67 | 5 or 6 " |
| 74 | 20 " |
| 63 | 3 " |
| 71 | 20 " |
| 67 | — |
| 63 | 6 or 7 years. |
| 63 | 1 " |
| 73 | 10 " |
| 66 | — |
| 89 | — |
| 75 | — |
| 84 | — |
| 77 | — |
| 83 | — |
| 68 | — |
| 74 | — |
| 68 | 4 years. |
| 85 | 20 " |
| 80 | — |
| 72 | — |
| 70 | — |
| 73 | 10 years. |
| 63 | — |
| 74 | 5 years. |

| Age of patient. | | Duration of disease. |
|---|---|---|
| 76 | | — |
| 84 | | — |
| 67 | | — |
| 79 | | — |
| 64 | | — |
| 78 | R. accident 50 years, L. 20 | — |
| 71 | | — |
| 75 | | 20 years. |
| 80 | | 20 " |
| 83 | | — |
| 74 | | — |
| 68 | | — |
| 70 | | — |
| 83 | R. over 12 years, L. over 20 | — |
| 55 | Very slight till lately | — |
| 82 | | — |
| 78 | | 6 or more years. |
| 83 | | — |
| 74 | | 15 or 16 years. |

In many of the cases it was impossible to obtain a definite statement as to the length of time during which the disease had existed, but I think we may infer from the others that in few, if any, had the contraction begun before the age of fifty. It would thus appear that the percentage of cases of Dupuytren's contraction among the population depends upon the ages of the individuals examined, and that the greater the age the greater will be the proportion of this affection.

In the paper above referred to I discussed the etiology of the disease and recorded facts without offering any opinion of my own. The majority of writers upon this affection attribute it to gout, and undoubtedly in a great number of the individuals who came before us a tendency to gout can be recognized. The ordinary case of Duputren's contraction does not, however, necessarily exhibit the common symptoms of gout. In only a small proportion of cases have I seen this affection in patients who were in other respects gouty and in whom there were enlarged finger-joints, and I have never seen any deposit of urate of sodium in the nodulated fascia so peculiar to Dupuytren's contraction.

Referring again to my paper, the records state that of the 11 women whom I examined, none acknowledged to having had gout;

of the 45 men, 2 acknowledged to rheumatic gout and 3 to gout; 19 denied ever having suffered from either gout or rheumatism, while the 21 remaining had only suffered occasionally from ordinary slight rheumatism.

Whether we consider the origin to be gout or not, we may, I think, assume that the retention in the blood of excretions and toxines which ought to be eliminated probably has an influence in causing this contraction and induration of fascia, and, although among the 70 patients whom I found in workhouses so few complained of gout, yet it is highly probable that all of them suffered at times from errors of diet and consequent accumulation of effete matters in the blood.

*The First Stage of Dupuytren's Contraction.* I have now to record an interesting case in which the contraction was observed in the very early stage, and the history of which may throw some light upon the subject of origin. In a man aged fifty years a nodule about the size and shape of half a small pea developed subcutaneously at the base of the ring finger of the left hand at the position of the transverse fold. The patient first became aware of its presence by feeling pain in that part. The nodule was distinctly defined and painful on pressure, and there was a slight increase of redness in its immediate neighborhood. It was a source of distinct irritation to him, and a few days later the palmar fascia extending from the nodule to the base of the ring finger became slightly contracted. Although I had never previously seen a case of Dupuytren's contraction in this early condition, the appearance was quite characteristic of the affection. The patient was a strong, healthy man, and had no constitutional disease whatever, with the exception of a tendency to rheumatic attacks, such as lumbago. His habits of life were healthy; his family history was very good; his mother had been healthy, with the exception of a tendency to slight muscular rheumatism; his father had been perfectly healthy, and both had died at about the age of seventy. His two brothers were quite healthy, and there was no history of gout in any known member of the family. This patient was in the habit of occasionally taking a blue pill or other mercurial purgative to act upon the liver, but said he had not done so recently. He seemed to be suffering from what is commonly called a "bilious attack." I administered a full dose of

pil. cathart. comp. U. S. Pharmacopæia (a preparation which I have found an excellent combination). This treatment was followed by relief of the pain in the hand the next day, and the nodule rapidly subsided, so that after several repetitions of the purgative at weekly intervals the active symptoms entirely disappeared and only a slight hardening and contraction remained. A few months later nothing was left but a very slight hardening of the fascia in the neighborhood where the nodule had appeared, and all signs of linear contraction had gone.

I believe that this was a case of incipient Dupuytren's contraction, and that if it had not been for the active treatment adopted the induration of fascia would have become organized and permanent, and have acted as a centre of further mischief. Of course, one such instance is not sufficient upon which to base a theory, but it seems to me to possibly represent the manner in which this affection begins.

In conclusion, I would add a few words regarding treatment. At the time I published the paper on my observations of the 70 cases of Dupuytren's contraction which I had examined, I advocated subcutaneous division of the contracted bands by as few incisions as possible sufficient to allow of full extension of the fingers. Since then I have learned the value of multiple incisions and punctures of the nodulated portions of fascia in addition to section of the contracted bands. These multiple incisions cause a rapid absorption of the hardened tissue, a fact which was first noted and acted upon by my friend, the late Mr. William Adams. In my experience, there is no surgical treatment more satisfactory than subcutaneous section in Dupuytren's contraction.

I have not found much tendency to recurrence, but even if every case were to begin to recontract after the lapse of months or years, and were to require further operation, such treatment would, I suggest, yet remain a desirable method. I have not yet found it necessary in any case to excise the hardened and contracted tissue.

# TWO NEW INSTRUMENTS.

By COMPTON REILY, M.D.,
BALTIMORE.

## I. A Staphylorrhaphy Suture-passer.

This instrument is devised especially for suturing cleft palates, but may also be used for vesicovaginal fistula. It is composed of six pieces so constructed as to take the place of a needle, needle-holder, and mouse-tooth forceps. The two long pieces, *a* and *b*, consist of handles and lock like those of scissors, with long shanks of unequal length, in the lower ends of which there are long, narrow slots in which parts of the pieces *c*, *d*, and *e* play. The lower inch of the shank, *a*, is bent at an angle of about 80 degrees, and near its free end there is an oblong hole through which the needle passes when the handles are compressed. This piece also acts as one blade of two forceps, the other blades of these forceps being *c* and *e*. An angular piece, *c*, is hinged at its angle in the slot in the angle of *a* by means of a rivet. Its upper end is flat and works in the slot of *b*'s shank, and also has a slot in which a rivet through the shank of *b* works and by means of which the required movements of *c* take place. The lower end of *c* has a slot for the passage of the needle. It is spring-like in character, in order to adapt itself to the palates of varying thicknesses, and in conjunction with the lower end of *a* acts as a mouse-tooth forceps for holding the flap while the needle passes through.

A U-shaped needle, *d*, is employed, one arm of which is hinged at about its centre in the slot of the lower end of *a*, a little beyond its angle; its free end works in the slot at the lower end of *b*, and has a slot in which a rivet through the lower end of *b* works and by means of which the other arm, which has the eye near its pointed extremity, carries the suture through the palate.

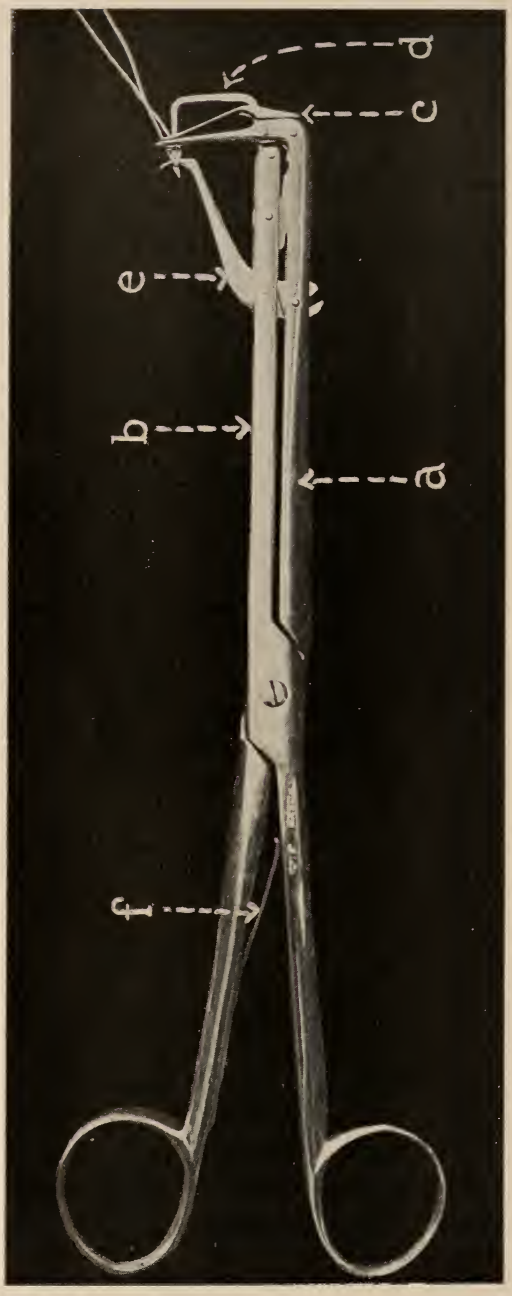



FIG. 1.

Staphylorrhaphy suture-passer (three-quarters actual size).

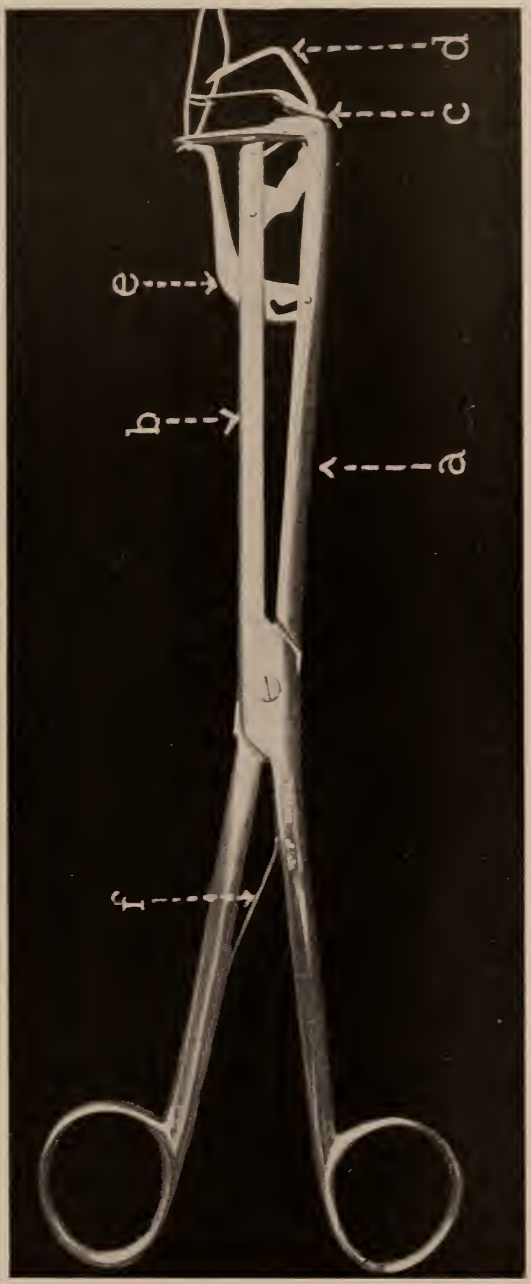



FIG. 2.

The same, handles pressed apart.

The piece *e*, shaped something like a human lower extremity, is hinged just above the knee-shaped portion by means of a rivet in the slot of the shank of *b*. Its upper end passes through the slot in the shank of *a*. In this upper end is a curved slot in which a rivet through the shank of *a* works, by means of which the foot-shaped portion is made to pass between the needle and suture and press it down on the end of *a*, with which it acts as a forceps for holding the suture while the needle passes back through the palate. This last movement takes place when the handles are separated. A spring, *f*, aids in separating the handles. The handles are slightly curved, so that the hand of the operator may not obstruct the view of the field of operation.

Position of the Table, Patient, and Operator. The patient, having been prepared in the usual way, is anæsthetized and placed on the table, the foot end of which has been slightly elevated. The head hangs over the low end, the neck being supported by a pillow. This position is advantageous, not only in preventing the blood from interfering with respiration, but also in placing the roof of the mouth down, making the cleft more accessible for operation. The operator stands with his right side to that of the patient.

Operation. The mouth is held open by means of a gag, preferably Whitehead's on account of its tongue-depressing attachment, but in case this instrument is not at hand the tongue can be held forward by means of a piece of silk passed through its tip and held well against the floor of the mouth by means of a long, narrow-bladed retractor. The edges of the cleft are denuded thoroughly (special care being used in the angle), and this is best accomplished by catching the uvular end of one side of the cleft with a mouse-tooth forceps, making it tense, inserting a small-bladed scalpel a little beyond the angle, and, with a sawing motion, cutting toward the uvular end. This same procedure is to be used for the other side.

When one is threading the needle the instrument is held in one hand, with its convexity away from the operator, the handles directed downward and the point of the needle directed to his right. The suture, which should be of silk, about fifteen inches long, is passed through the eye of the needle from the near side,

only drawing it through two or three inches, so that the longest end is next to the operator. The instrument is now inserted into the mouth, with the point of the needle directed first toward the left side of the angle of the cleft. The forceps portion of *a* and *c* take the place of mouse-tooth forceps in holding the flap; they are placed with the blade *c* to the nasal and *a* to the buccal side, in such a way that the oblong hole at the lower end of *a* comes over the desired suture point. The handles are now compressed until the shanks touch, this action carrying the threaded needle through the flap. When this is accomplished the handles are separated. By this action the short end of the suture is caught on the buccal side by the forceps portion of *a* and *e* and the threaded needle passes back to the nasal side. The instrument is then withdrawn from the mouth until the needle comes within two or three inches of the end of the long portion of the suture, and the handles are now compressed just enough to release from the grasp of *a* and *e* the former short end of the suture, which is held out of the mouth. The instrument is again inserted into the mouth and the suture passed through the opposite flap in the way just described. When the instrument is withdrawn from the mouth the second time the needle will be found unthreaded, and what was the former long end of the suture in the grasp of the forceps portion of *a* and *e*. This should be released, and with the other end clamped with a forceps until all the sutures have been passed in the same way; then the sutures should be tied, beginning at the angle.

The next step is that of relieving tension, which may be accomplished by any of the following methods: By chiselling off the hamular processes; by cutting the levator palati and the tensor palati where it passes over the hamular process; by Brophy's method, as described in Park's *Surgery;* or by making an incision through the muscles of the soft palate near enough to the median line to avoid cutting the posterior palatine artery, which runs along the inner side of the base of the alveolar process. This incision should not be carried through the posterior border of the palate. The latter method is the one with which I am most familiar, and it has proved very satisfactory.

Distribution of tension (a very important point) is attained by

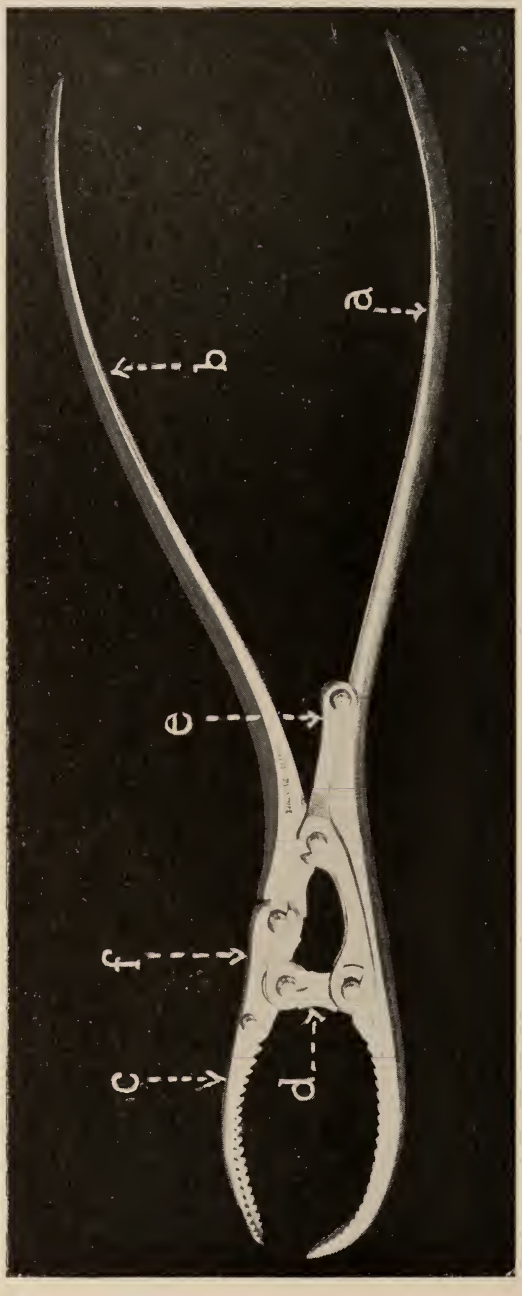



FIG. 3.

A giant bone-forceps (three-quarters actual size).

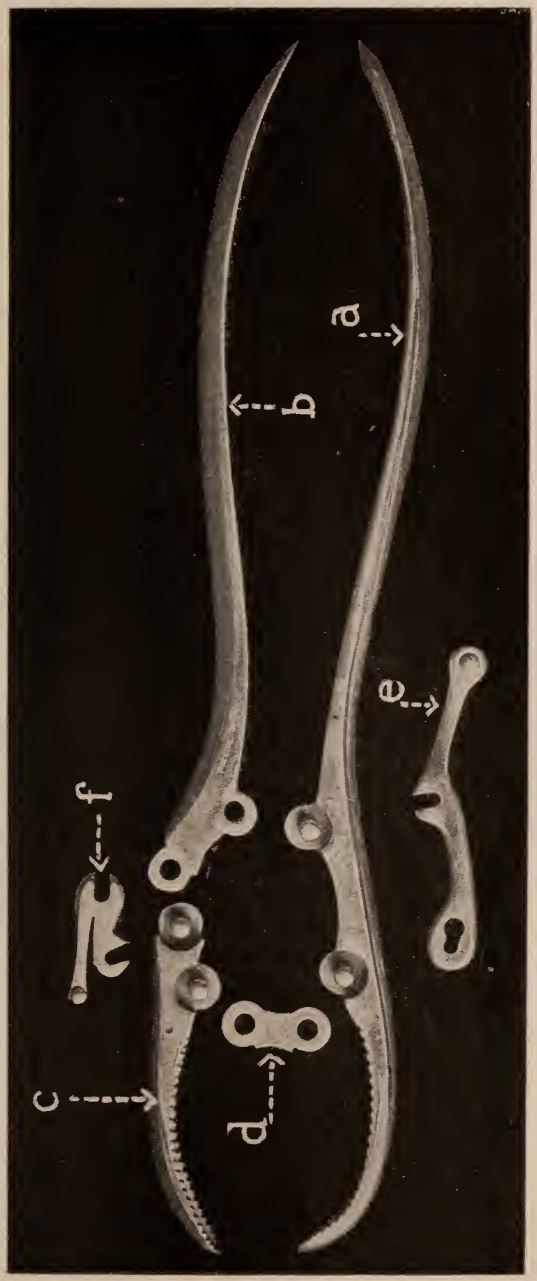



FIG. 4.

Giant bone-forceps taken apart.

inserting the sutures close together, certainly not further apart than three-sixteenths of an inch. This renders them less apt to cut out or cause abscesses, and keeps the edges in perfect apposition, which is requisite for prompt and perfect union. Very probably the frequent failures to obtain union are largely due to this neglect, owing to the difficulty in passing them.

The advantages of this instrument are that it does not have to be threaded in the mouth; that the sutures are passed much quicker and easier; that the needle does not cut such large holes; that it avoids manipulation with mouse-tooth forceps, which bruise the tissues and thereby render them less apt to heal; and that by shortening the time of operation the amount of hemorrhage and shock is lessened.

## II. A Giant Bone-forceps.

This instrument is intended to take the place of the lion-jaw forceps in joint resections, in amputations, and in plating compound and old ununited fractures. It is composed of six pieces, with four joints for the purposes of obtaining compound leverage and adjustment to bones of different sizes.

The handles, joints, and jaws are shown in *a*, *b*, *c*, and *d*; *e* and *f* are keys for holding the pieces together, by the removal of which the parts can be separated for cleansing and sterilization. Further description is not necessary, as its mechanism is simple and can be readily understood from the accompanying cuts.

The advantages alleged for this instrument over the lion-jaw forceps are that injury to the tissues is less apt to occur, as it cannot slip, owing to its tighter grasp and the fact that the distance between the points of the jaws is always less than the diameter of the bone in their grasp; that the serrations point toward the handles; and that in plating bones it is more easily applied because of its jaws being thin and curved, thereby disturbing the soft parts less.

These instruments have been made for me by the Charles Willms Surgical Instrument Company, of Baltimore.

# OBSERVATIONS ON BROKEN NECKS.

By REGINALD H. SAYRE, M.D.,
NEW YORK CITY.

Fracture of the cervical spine is by no means necessarily fatal, although the lay mind always associates a broken neck with death occurring either at the time of the accident or soon thereafter.

Of course, in many of these cases the violence done to the spinal cord at the time of the injury to the vertebræ is so great that death takes place at once; or else, should the injury be sufficiently low down, the patient lives for a comparatively short period, completely paralyzed below the point of injury. The life of these patients is wretched in the extreme; not only are they subject to bed-sores due to the interference with the nutrition of the skin, in addition to those produced from pressure, but this condition is apt to be aggravated by the constant leaking of urine from the paralyzed bladder, which becomes overdistended and then overflows. Sooner or later the bladder becomes infected, either from careless catheterization or as a result of the decomposition of residual urine. The infection travelling upward to the kidneys, the patient usually succumbs to pyonephrosis. A fair proportion, however, of those who suffer from fracture of the cervical vertebræ recover from the accident, some of them becoming absolutely well, while in other instances a certain amount of deformity remains. This may be caused by one of three factors—imperfect reduction of the dislocation which so often accompanies these fractures, failure to approximate the fragments themselves, or occasionally to the over-production of callus. In making a diagnosis of fracture of the cervical spine the position of the head is of great importance, and any abnormality of position following an

injury to the neck should make one suspicious of a fracture, especially if there is any pain or weakness in the upper extremities. If the injury have been in one of the three upper vertebræ the head has always, in the writer's experience, been twisted to one side, much after the manner of torticollis (see Fig. 1). The same position, which is seen in a most aggravated form in Fig. 2, is always noted in chronic tubercular inflammation of the second cervical vertebra, to which symptom the writer has drawn

Fig. 1.

Torticollis.

attention in previous papers before this Association (see vol. v., p. 250; vol. viii., p. 172, Transactions of the American Orthopedic Association). If the injury have been in the fourth or fifth vertebra there is apt to be a forward dislocation of the upper fragment, giving a curious perpendicular look to the back part of the head and neck, which is often accompanied by drooping of the face forward (see Fig. 3), so that at times the chin touches the chest. In all cases that have come under the writer's personal observation rotary movements have been completely abolished by

muscular spasm. This statement, of course, is not meant to refer to those cases where total paralysis followed the injury.

All these cases have suffered from weakness of the upper extremities resulting from pressure on the spinal cord, which weakness disappeared as soon as protection was afforded to the spine. One

FIG. 2.

Tuberculosis of second cervical vertebra.

case of broken neck who was not under treatment, but who called to be examined while passing through New York, had a decided twist in his neck, and at the time of his visit still kept his head supported by a jury-mast. He alleged that several attempts to

straighten the neck had been made by various physicians, but that whenever his head and neck were brought toward a normal position the weakness increased in his left arm, and he became faint. If the effort were continued the weakness increased to total

Fig. 3.

Fracture of fourth and fifth cervical vertebræ.

Fig. 4.

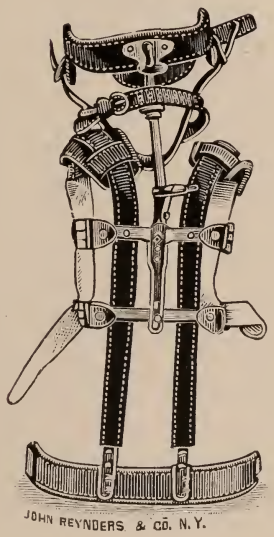
Apparatus used in one case of broken neck.

paralysis, and he lost consciousness soon after. When the head was allowed to resume its twisted position consciousness returned, and in a few days the left arm would regain its strength. Time did not allow a thorough examination of this patient, and he passed from under observation. He subsequently exhibited himself

in connection with various shows through the country, the head still twisted to one side and supported by the jury-mast.

It has been the writer's experience that cases of cervical fracture require support for a much longer time than is usually given. Two cases that have been referred by colleagues had been sent to them for diplegia brachialis, which came on some time after the original injury, and grew worse the longer they were on their feet. Both cases had the peculiar symptom of abnormal straightness of the back, and both had been treated for some weeks by rest in

FIG. 5.




bed in different hospitals. On being discharged no support had been applied, presumably because none was supposed to be needed. A diagnosis of fracture of the cervical spine with pressure on the cord was made in both of these cases, and both wore support for three months after coming under observation, one using a jury-mast and the other the apparatus shown in Fig. 4. After this period of protection each remained absolutely well save for a slight amount of limitation of motion in the neck. In another case—a boy who broke his neck while making a "lion dive" in a gymnasium—the apparatus shown in Fig. 5 was worn for a

long time, as each attempt to remove it, made at intervals of three months, was followed in a few weeks by pain and stiffness, in consequence of which the apparatus was reapplied, so that the patient was altogether about a year under treatment.

Fig. 6.

Skiagram of vertebræ of patient shown in Fig. 4.

The X-ray may be used as an aid in the diagnosis, but care must be taken in interpreting the picture, lest errors occur, the writer being able to testify to the misleading results that may be obtained from its use. The skiagram (Fig. 6) which accompanies this article was obtained only after three unsuccessful attempts had

been made. The first two pictures showed nothing, but the third seemed to indicate the possibility of trouble below the lower margin of the plate. A bandage was therefore passed under the armpit on one side, over the shoulder on the other side, and into the sulcus thus formed in the neck the lower edge of the plate was forced, with the result that a most excellent picture was obtained.

In the great majority of cases of broken neck the same principles of treatment are to be applied that govern the treatment of any other fracture. The fragments are to be adjusted as nearly as

FIG. 7.

possible in their normal position and retained there, preferably by a plaster-of-Paris dressing. If the patient can stand, the simplest way is to apply a plaster-of-Paris jacket as if for Pott's disease, the patient being carefully suspended by the head and arms. When this has set, continue the bandages over the shoulder and around the neck, having, of course, removed the chin-piece of the suspension apparatus, the patient's head being supported by the hand of your assistant. The bandages should envelop the entire head, leaving out the face (Fig. 7) ; pieces of malleable steel

should be added to give greater strength to the neck. It may be impossible for the patient to be raised to an upright position, and one of the best results I ever saw was obtained by adjusting the fragments while the patient lay on her back in bed, and then mixing thick plaster-of-Paris and pouring it around her neck so that the head and shoulders were held immovable as she lay in bed. The patient lay on her back in the bed in this position six weeks, when she was cut from her plaster-of-Paris shell, and an apparatus was applied to support the head and neck and allow her to walk. The usual mode of supporting these patients by sand-bags seems to the writer to give very uncertain protection, and is not a method to be adopted under ordinary circumstances. The patient just mentioned had agonizing pain on the slightest motion, but after being embedded in plaster-of-Paris she was perfectly comfortable. Sometimes it may be practicable after a time to substitute a steel support for plaster-of-Paris, and two of the cases mentioned here wore at one time in the course of treatment the apparatus shown in Fig. 5. This consists of a pelvis belt attached to two back-bars, which are fastened to an extension rod by a universal joint at the seventh cervical vertebra; this rod joining a head-piece by another universal joint, the apparatus can be adjusted to any position of the body and head, which position should be rectified later on as fast as may be practical. In some of the cases it has not been possible to completely rectify the deformity at the first sitting, but after a week or so the head could be put straight. In the case in which the skiagram (Fig. 6) showed fracture of the fifth cervical vertebra, with forward dislocation, a different mode was adopted; the head was manipulated as nearly as possible into position, and the apparatus shown in Fig. 4 was applied. This consisted of two iron rods reaching from the back of the neck to the pelvis, where they were attached to a cross-bar. An apron held the rods in place on the body, and a collar around the neck kept the head in position. From time to time the rods were bent backward by monkey-wrenches, and the position of the head thus brought nearer normal. After three months, rotation, which had been absolutely abolished, was quite free, and lateral flexion had also returned. The patient was allowed to abandon the use of the apparatus at night as a tentative measure, and little by

little to leave it off in the daytime. He has had no return of the paralysis, and feels perfectly well. The apparatus shown in Figs. 8 and 9 may also be employed in such cases with great benefit.

Reference has not been made to the cases of broken neck which require operative intervention to relieve pressure on the spinal

FIG. 8.

FIG. 9.

cord, or to those where it seems necessary to wire the fragments together in order to secure accurate adjustment, as the time allotted has been limited. The endeavor has been rather to draw attention to certain diagnostic points which distinguish fractures of the cervical vertebræ and to emphasize the necessity of protection for a much longer period than is often deemed necessary.

# THE TREATMENT OF POTT'S DISEASE IN CHILDHOOD BY CONTINUOUS OVER-EXTENSION OF THE SPINE.

By ROYAL WHITMAN, M.D.,
NEW YORK CITY.

It may be claimed for the operation of forcible correction of the deformity of Pott's disease, that although it is likely to fall into practical disuse, it has effected a distinct advance in the knowledge of, and consequently in the treatment of, this affection. For example, it has now been established by clinical experience and by pathological investigation that the capacity for formation of new bone in this region is quite inadequate to replace the loss of even one vertebral body, consequently there can be no remedy for that part of the deformity directly dependent upon loss of tissue.

On the other hand, it has been demonstrated that the distorted spine may be straightened with comparative ease, not only by force but even by much milder methods that do not entail danger to the patient.

Thus, the importance of checking the destructive process has been emphasized, and the routine of treatment is likely to be more or less modified in the future to meet this requirement.

To one such modification in the direction of more direct and positive treatment I shall call your attention briefly.

It may be assumed that when the local disease has advanced to the destructive stage there is actual contact of the eroded segments above and below it. This is indicated by the persistence of local deformity under mechanical treatment and by its inevitable recurrence after forcible correction, however much the secondary distortions may be modified. Although such contact may be essential

to final consolidation and repair, yet during the destructive stage it is attended by pressure and friction. This was impressed upon me when in evacuating an abscess in the posterior mediastinum, complicating Pott's disease of the thoracic region, I was able to insert my finger between the apposed vertebral bodies. Here, although the patient was recumbent, it was forcibly compressed at each respiration, the trunk moving backward and forward upon the articular processes as on a hinge.

Pressure and friction are the most important of the factors that contribute directly and indirectly to the advance of the destructive process and to consequent deformity. The direct influence varies with the situation and the quality of the disease. It is probably present to some degree whenever the softened vertebral bodies are in contact, and it is exaggerated doubtless when superincumbent weight is combined with the actions and postures peculiar to the erect attitude, however much it may be lessened by mechanical support.

It is evident then that actual separation of the mutually diseased surfaces offers the best opportunity for repair since the exciting causes of the progressive destruction are removed and the attendant danger of wide-spread infection of the neighboring tissues lessened. If this is only possible in the recumbent posture it follows that recumbency is an essential part of the most effective mechanical treatment.

The treatment of a chronic disease of this character is often somewhat of a compromise, a more efficient method being displaced for one that offers reasonable palliation, either because it is less difficult or for other reasons of more or less importance. In order to avoid this issue I shall limit myself to a consideration of Pott's disease in children less than three years of age, a class in which recumbency should be for a time the treatment of selection and routine.

The apparatus that I employ to assure horizontal fixation, or what may be termed ambulatory recumbency, as distinct from confinement to the bed, with which it is often confused, is a modified stretcher or Bradford frame. This apparatus, as it is ordinarily constructed and as it is described by Bradford and others, is a rectangular frame of gaspipe somewhat longer and

somewhat wider than the patient, which is covered except for an interval in the centre about 6 inches in width with cotton sheeting drawn as tight as possible. (Fig. 1.)

The efficiency of this admirable appliance may be increased by changing it in several particulars: for example, in width, in shape, and in covering. The width of the original frame, in proportion of about 1 to $3\frac{1}{2}$ of length, is such that a certain amount of sagging of the cover is unavoidable, and in practice I have found it feasible to reduce it very materially; to make width as to length 1 to 5 or slightly less, so that the support is somewhat narrower than the body of the patient. At first thought it would seem that the side bars would cause uncomfortable pressure on the overhanging shoulders, but as the arms

FIG. 1.

The Bradford frame. (From Bradford and Lovett.)

are set upon the middle of the lateral aspect of the trunk, and thus on a considerably higher plane than the dorsum, there is but bare contact when the cover is fairly rigid.

The second and most important modification, and one that I have employed for several years, is to so bend the frame as to gradually force the spine into over-extension, the aim being first to overcome deformity and finally to obliterate all the curves of the spine, normal or otherwise, by bending the body backward. In this attitude it may be assumed that the vertebral bodies are separated from one another to an extent that is practicable, and that direct pressure is entirely removed from the seat of disease. (Figs. 2 and 3.)

The Bradford frame, the Phelps bed, the wire cuirass and

FIG. 2.

The modified frame.

other portable appliances of this character were designed simply to support the trunk in the horizontal position. Recently the

Fig. 3. The modified frame, illustrating over-extension of the spine and gravity traction.

advantage of appropriate padding to hold the spine in the extended or over-extended position has been recognized. It has been ap-

plied, however, rather to assure better fixation at the diseased area and to preserve the physiological curves in the lumbar and cervical regions than, by over-extension of the entire spine, to obliterate them. It may be stated also that padding is in practice a very unsatisfactory support, and particularly so in the treatment of patients who are seen at infrequent intervals.

I may mention in this connection that in 1895, Selva (TRANSACTIONS OF THE AMERICAN ORTHOPEDIC ASSOCIATION, vol. viii., p. 225), (Fig. 4), suggested bending the frame so that the

FIG. 4.

Selva's modification of the Bradford frame. (From Bradford and Lovett.)

trunk might be supported on a higher horizontal plane than the head and buttocks. This bending was made before the apparatus was applied, its object being rather to assure better support and fixation from the beginning of treatment than to progressively change the entire contour of the spine in the manner that has been described. The difficulty in adjusting this appliance explains doubtless the neglect of a valuable suggestion.

The third modification is to make the cover of strong canvas in one piece. This assures more effective support than when it is divided into two parts, and for children of this age who wear diapers it is equally cleanly and convenient. (Fig. 2.)

The construction, application, and further use of the appliance may be described to illustrate the changes and for the benefit of those who may be unfamiliar with this form of treatment.

The stretcher frame is made of ordinary galvanized gaspipe or of steel tubing of a smaller diameter. It should be about 4 inches

longer than the child and about four-fifths as wide, the lateral bars corresponding to the articulating surfaces of the four extremities

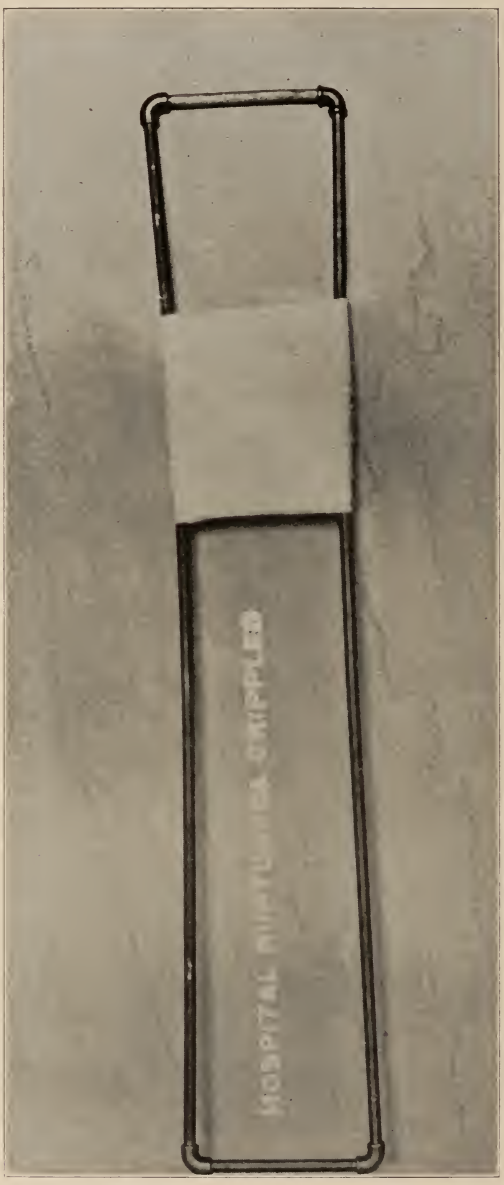
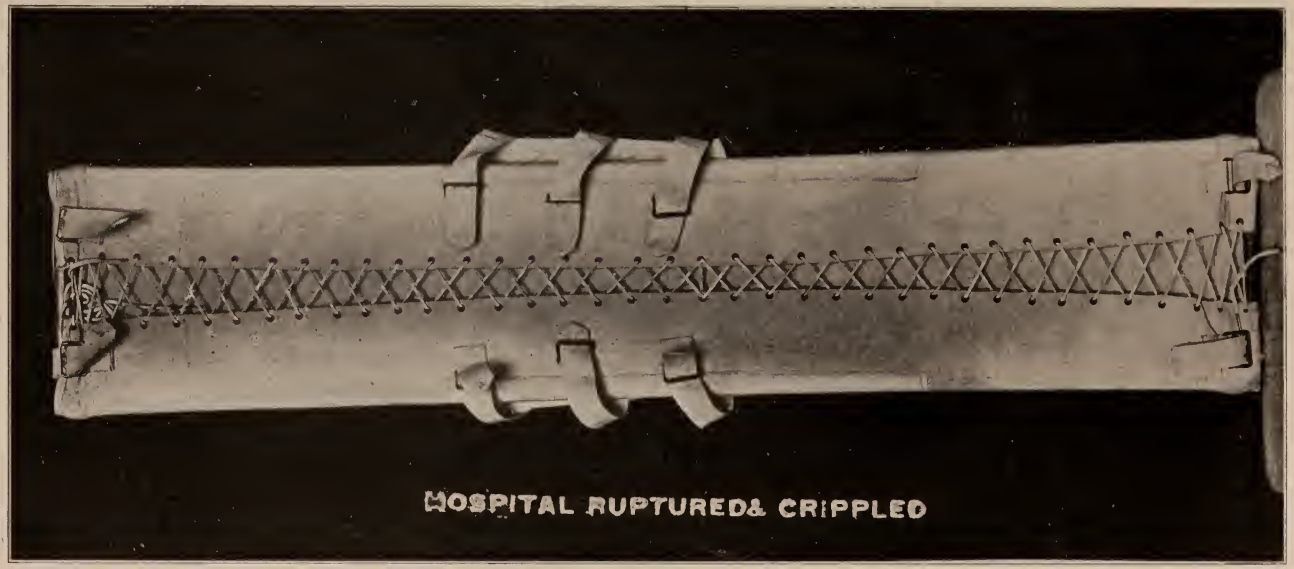


FIG. 5.

The modified frame, illustrating the application of the bandage.

Fig. 6.




The modified frame, illustrating the adjustment of the cover.

with the trunk. The ordinary dimensions are $7\frac{1}{2}$ by 38 inches, or, as has been stated, width to length about as 1 to 5. Before

FIG. 7.

Characteristic deformity of Pott's disease at an early stage. (See Fig. 8.)

the cover is applied one may with advantage wind bandages tightly about the frame at the point which is to support the body in order to assure as much rigidity as possible. (Fig. 5.) The

FIG. 8.

The routine method of fixation. Same patient as in Fig. 7.

cover should be of strong canvas suitably protected in the centre by rubber cloth. This is applied and is made as unyielding as possible

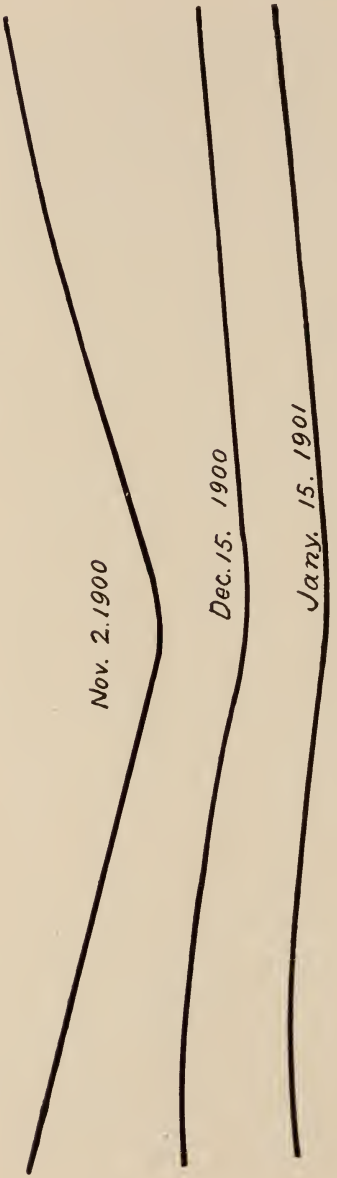



FIG. 9.

Tracings of the spine, showing recession of the deformity under treatment. The patient is shown in Fig. 3.

by means of the corset lacings and straps. (Fig. 6.) Upon this two thick pads of felt are sewed; these should be about 7 inches in length and about $\frac{3}{4}$ inch in thickness, so placed as to pass on either side of the spinous processes at the seat of disease, thus protecting them from pressure, fixing the part more firmly, and increasing the leverage of the apparatus. The child, wearing only an undershirt, stockings, and diaper, is placed upon the frame and is fixed there usually by a front piece or apron similar to that used with the spinal brace. (Fig. 8.) In certain instances it may be advisable to fix the shoulders more firmly by an anterior brace, to apply traction to the head or legs, to restrain the movements of the limbs or to assure greater local fixation of the trunk by the application of a brace or plaster jacket. In the routine practice, however, these modifications are not required if the apparatus is properly adjusted.

As soon as the patient has become accustomed to the restraint, one begins to overextend the spine by bending the bars from time to time upward beneath the kyphosis, with the aim, as has been stated, of actually separating the diseased vertebral bodies and obliterating all the physiological curves of the spine, so that the body shall be finally bent backward to form the segment of a circle. The greatest convexity is at the seat of disease, and as the head and lower extremities are on a much lower level, an element of gravity traction is present in some instances, while the support of the spine as a whole is much more comprehensive than when the body lies upon a plane surface. (Fig. 9.) The gradual over-extension of the spine by bending the frame in this manner is so definite and simple that it may be carried out easily by the physician, and it may be exaggerated slightly to compensate for the sagging of the cover. Thus, it is far more effective than any form of padding or other form of support with which I am familiar.

Upon this frame the child lies constantly, its clothing being made sufficiently large to include the apparatus, thus assuring additional fixation. Once a day in most instances the child is removed from the frame and is carefully turned face downward upon a large pillow; the back is then inspected and powdered, the frame arranged and the apparatus is then reapplied. It is, of

course, desirable to have two equipped frames, but this is by no means essential.

The effect of this continued fixation upon the back is not merely to change the contour of the spine but of the entire trunk as well ; to flatten and broaden the thorax. This increase of the lateral at the expense of the antero-posterior diameter is quite the reverse of the natural tendency of the deformity, and it is therefore a favorable rather than an unfavorable effect of treatment. The same tendency in the lower region may be checked by the use of a flannel binder such as is ordinarily worn by infants. As this frame is simply a horizontal brace the child may spend as much time in the open air as would be practicable were any other appliance used. Meanwhile, it may be assumed that the spine in its development is uninfluenced by the deformity, whereas under the most effective bracing in the upright posture it is influenced very decidedly by the local disease and distortion.

Personally I have never seen other than favorable results from this method of treatment. Pain and discomfort are, as a rule, relieved almost immediately, and there is a corresponding improvement in the general condition of the patient. Meanwhile the growth of the trunk, which is so often checked by the disease and by the deformity, appears to progress with normal rapidity, so that the apparatus may be actually outgrown before the termination of this part of the treatment. I am, therefore, rather inclined to regard the supposed benefit of exercise in cases of this character and at this age as one of the several delusions that have retarded the progress of positive treatment.

Horizontal fixation is, of course, a treatment not complete in itself, since it must be supplemented by the usual supports when the erect attitude is again assumed. Its duration varies from six to eighteen months. The indications for its discontinuance are the correction of deformity and the apparent quiescence or cure of the local disease. This is indicated by the physical signs and by the behavior of the patient, who as repair advances becomes restless when removed from the frame, evidently desiring to sit and to stand.

At this stage it is well to apply the ambulatory support some time before the patient is released from the frame, allowing little

by little the changes in attitude and habits. If the plaster jacket is to be used, it may be applied during longitudinal suspension or

FIG. 10.

A final result of treatment. No trace of disease remains. (See Figs. 11 and 12.)

otherwise, after which the child is immediately replaced upon the frame where the plaster is allowed to harden; thus it holds the

Fig. 11. Illustrating the flexibility of the spine. (See Fig. 10.)

spine in an attitude to which it has become accustomed. Such direct support is also of service during the active stage of the dis-

FIG. 12.

A Roentgen picture, illustrating disease at the junction of the first and second lumbar vertebræ. The destruction of tissue is indicated by the spaced lines and by the lateral distortion of the spine. (See Figs. 10 and 11.)

ease when the symptoms or physical signs indicate the desirability of more efficient fixation.

It is interesting to note the perfection of the cure in certain of the early cases treated by this method, so perfect that one would be inclined to doubt the diagnosis were it not for the unmistakable character of the symptoms. (Figs. 10 and 11.) In one such case I was fortunate enough to have the confirmatory evidence of the Roentgen picture that illustrates this article. (Fig. 12.)

In conclusion, I may say that the object of this paper is to advance the proposition that horizontal fixation should be the treatment of routine during the destructive stage of Pott's disease in early childhood. This proposition, although by no means novel, is not one that is generally taught or generally accepted.

Pott's disease is the most common and the most important of all the forms of tuberculous disease of bone. If it were recognized even when the diagnosis is made evident by local deformity and treated in the manner suggested, a treatment so simple and so definite in its details that it is quite at the command of the general practitioner, the disastrous deformities now so common in this class of cases would be prevented.

# OPERATIVE CASE OF INTRACAPSULAR FRACTURE OF THE HIP.

By CHARLES E. THOMSON, M.D.,
SCRANTON, PA.

My patient, an old man, sixty-two years of age, sustained a fracture in August, 1899. He was a miner by occupation, and the injury was caused by a fall of rock. No diagnosis was made at the time of accident. He was bedridden for three months; at that time he came under my care. A diagnosis of fracture of the neck of the femur was made, and afterward confirmed by X-ray photographs. The operation recommended by Gillette, of St. Paul, was proposed, accepted, and performed on December 12, 1899. It consisted of a horseshoe incision around the trochanter major down to the periosteum. The flap being elevated, a second incision, including the periosteum and a section of bone (about one-third thickness of the shaft) two and one-half inches below the trochanter, was made, liberated with an osteotome, and turned up. This enabled us to get nearer the seat of injury. In this particular case the fracture was found to be comminuted. Several pieces of bone were removed. The fractured ends were then adjusted and a solid silver nail, three-sixteenths of an inch in diameter and two and one-half inches long, was driven through the neck and into the head of the femur, as the skiagraphs show. We were gratified to find that the nail held the fragments quite firmly together.

The wound was closed with catgut suture and the entire leg and body encased in a plaster-of-Paris spica, extending from the axilla to the tips of the toes. The patient had no elevation of temperature. The initial dressing was removed at the end of two weeks. At the end of five weeks the plaster-of-Paris spica was removed and the patient allowed to move about. He left the hospital on crutches,

and improvement continued. Seven months after operation he complained of pain, and a few weeks later a sinus appeared at the seat of the incision, and this was followed later by an accumulation of pus in the gluteal region, which was evacuated under cocaine, but a slight sinus persisted. Improvement continued until last month (eighteen months after operation), which was the last time he was

seen alive by us, when he walked into the hospital without cane or crutch. He had ninety degrees of free and painless motion. Last Saturday night he retired as usual, and was found dead in his bed at five o'clock Sunday morning. The coroner made a diagnosis of "heart trouble."

The specimen and its skiagraph show that the bony union is firm and complete.

# SURGICAL TREATMENT OF CONGENITAL CLUB-HAND.

By P. REDARD, M.D.,
PARIS.

The case herewith presented proves the valuable efficacy of surgical treatment for the cure of a congenital club-hand with strongly pronounced deformities.

G. O., a robust child, aged two years, was brought to us with a club-hand (the right), the deformity being extremely marked. The defect was at the lower extremity of the radius. The thumb had its normal shape, but the middle finger was strongly bent, being retained in this false position by the flexor tendons and retracted sinews (bridles). A linear depression or scar of the skin occupied the whole internal face of the forearm, but the articulation of the elbow was normal. Figs. 1 and 2 show these different particulars, especially the strong deviation of the hand on the radial border (radial distortion) and the decided rolling up of the whole forearm owing to the pronounced curvature of the cubitus.

After ineffectual attempts at straightening by manipulations and the aid of orthopedic apparatus in plaster we decided on surgical action. This we divided into two operations.

The first was a subcutaneous section of the cubitus in its middle part, followed by a manual straightening, and then by an immobilization by means of a plaster cast. The hand and forearm were carefully kept in position by the apparatus represented in Figs. 3 and 4.

The first part of the operation gave a straightening quite notable, but far from sufficient, as the hand still had a strong tendency to deviate to the radial side. The radiograph (Fig. 5) shows

the state of things six months after the beginning of the first part of the operation. It indicates the decided success we had so far obtained in straightening the cubitus.

In the second part of our operation we got rid of a trapezoidal fragment of the lower extremity of the cubitus, and then sutured the separated bones by means of Clemente Romano's procedure.

Fig. 1.

We made an incision to the periosteum, about three centimetres in length, along the internal border of the cubitus, going about as far as its third, but not passing beyond the styloid process. The cubito-carpal articulation (at the wrist) we handled with exceeding care.

A very oblique section of the bone, from below upward and

from within outward, beginning at a half centimetre above the styloid process, was then made with a small saw. By making a transverse section a little higher up we were enabled to detach the trapezoidal fragment of the cubitus. In consequence, the hand could soon be brought to an easy adduction motion, the fibrotendinous parts not opposing the movement, so that a cutting of the muscles

FIG. 2.

or tendons was not necessary. The two surfaces of the bony section having united exactly, the deviation of the hand toward the radial border was soon completely corrected. Two lines of suture with silver thread, one median and the other lateral, kept the bony fragments in proper position. The skin being sutured with (Florentine) horsehair, the arm, the forearm, and the hand were placed in

plaster grooves and kept there until the wound healed, which it soon did without suppuration. At the end of fifteen days the limb was taken out of the plaster grooves and submitted to massage.

The straightening thereby obtained soon became perfect, and it is now, at the end of two years, all that is desirable. The forearm

Fig. 3.

is perfectly straight, the hand no longer experiences a tendency to deviate toward the radial border, and all the movements of the hand and fingers are quite free and easy. (See Figs. 6 and 7, after cure.)

This report shows the excellent results to be obtained by the

FIG. 4.

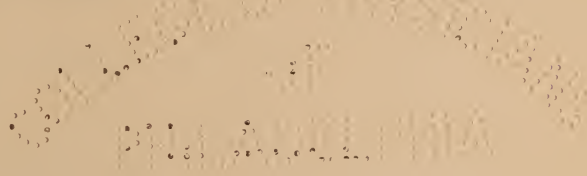
FIG. 5.

Fig. 6.

Fig. 7.

judicious section and resection of the bones of the forearm in a bad case of congenital club-hand.

With Bardenheuer, MacCurdy, Cl. Romano, R. Sayre, R. Smith, G. Norwell, and E. Thompson, we are decided advocates of the surgical treatment of the bones of the forearm and wrist for the cure of club-hands or other deformities of the forearm arising from congenital absence of the bones.



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